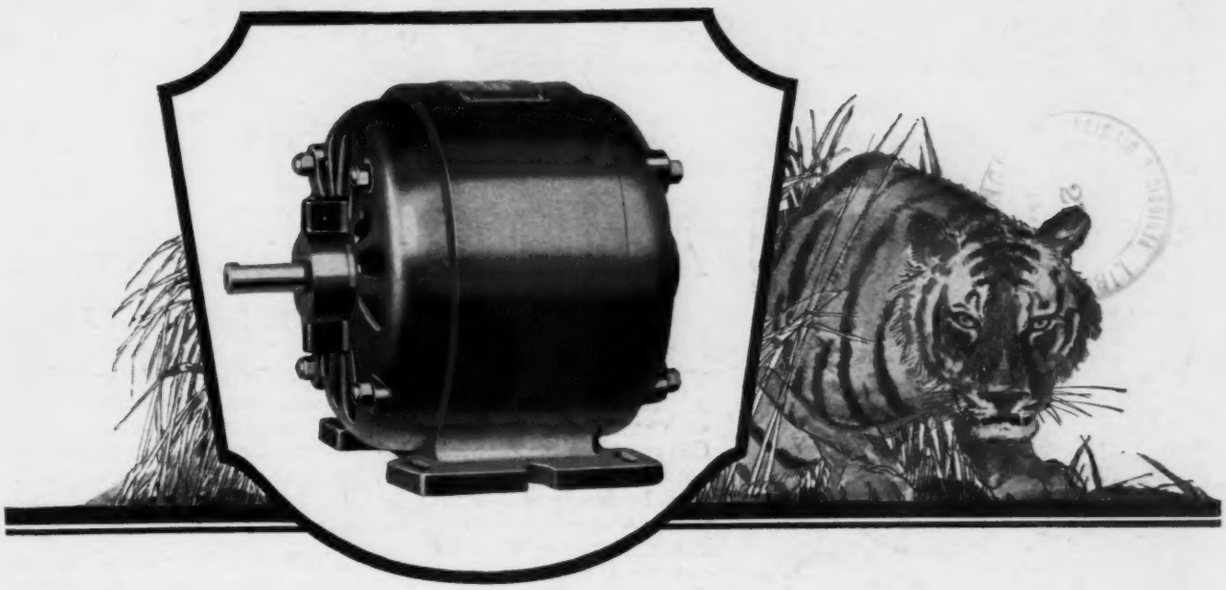
Nov. 1928

Electrical Manufacturing

Vol. 2 A Gage Publication No. 5



Quiet Power ~ ~ ~

What Users Say:—

Mr. P. F. Noess of the Shallcross Control Systems Company writes:

"We have been using this motor exclusively for about the last five years and find that, considering the very severe service to which we subject this motor, it stands up equally as well, if not better than any other make of motor of its type. At the time that we first investigated this motor, we also investigated nearly all of the similar motors on the market.

"We are utilizing this motor in an application which requires 100% reliability, to the extent that the motor is continually reversing for twenty-four hours a day every day of the year."

"WE require 100% Motor Reliability." Many manufacturers of motor driven devices select the motor on such a basis. They know that satisfactory sales demand the same degree of reliability in the motor as in the device itself.

Whether the service you require is 24 hours a day, 365 days a year, or only intermittent, that same motor reliability is essential.

Ohio Motors have long been known as the Reliable Motors. They have been tested and approved by many of the leading manufacturers of motor driven appliances. The reason is simple. Ohio Motors are practically custom built. All material is rigidly inspected. Every machining and assembly operation must meet the most rigid specifications.

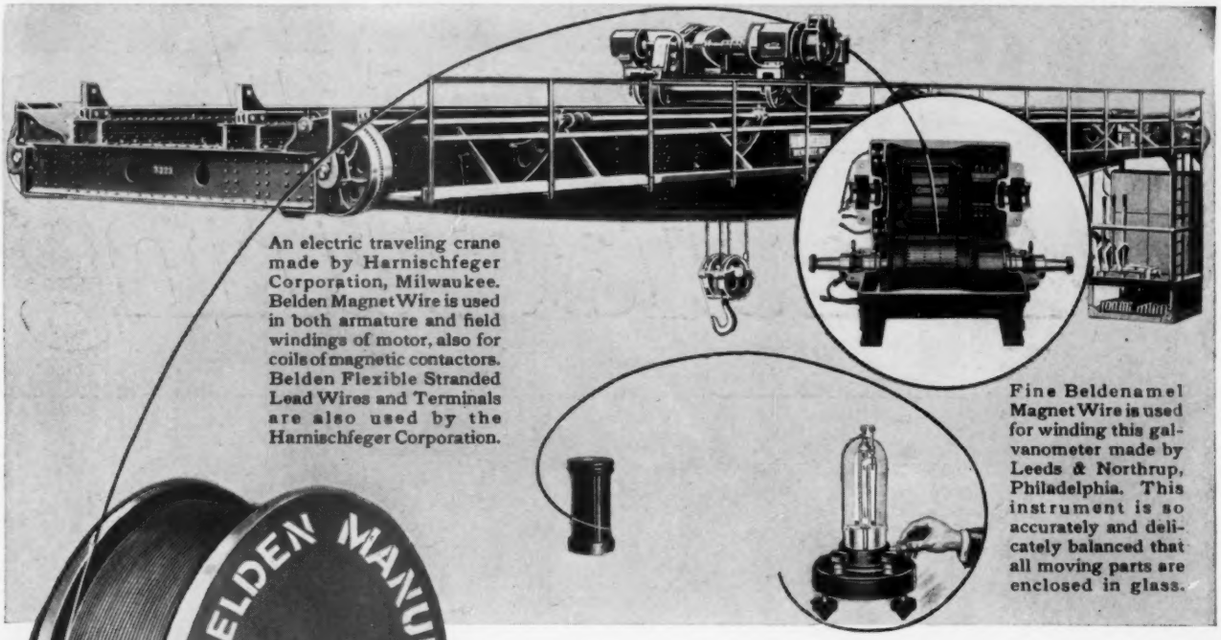
This makes the price of an Ohio Motor slightly higher, but worth it in Quiet and Reliable Operation.

Ohio Motors meet all N.E.M.A. and N. E. L. A. specifications.
Sleeve Bearings or Ball Bearings. 1/20 to 1/3 H.P.

THE OHIO ELECTRIC & CONTROLLER COMPANY
5905 Maurice Avenue, Cleveland, Ohio

OHIO reliable MOTORS

OHIO MOTORS



An electric traveling crane made by Harnischfeger Corporation, Milwaukee. Belden Magnet Wire is used in both armature and field windings of motor, also for coils of magnetic contactors. Belden Flexible Stranded Lead Wires and Terminals are also used by the Harnischfeger Corporation.

Fine Beldenamel Magnet Wire is used for winding this galvanometer made by Leeds & Northrup, Philadelphia. This instrument is so accurately and delicately balanced that all moving parts are enclosed in glass.

A Complete Magnet Wire Service *for Electrical Manufacturers*

FROM magnet wire more than one-third inch in diameter, such as is used by Harnischfeger Corporation, to Beldenamel Magnet Wire finer than human hair, used by Leeds & Northrup in their delicate instruments, the Belden Magnet Wire Service covers a complete range of sizes, shapes, and insulations.

Big and small Magnet Wire, round, square and rectangular Magnet Wire—Beldenamel, Cotenamel, and Silkenamel Magnet Wire—Cotton Covered, Silk Covered, and a tremendous variety of other forms of wire and insulation to meet every imaginable need are included.

The Belden Engineering Department will work with you and help you select the correct size and type of wire and form of insulation best suited to your requirements.

Learn about the Belden Complete Magnet Wire Service. Write today for data.

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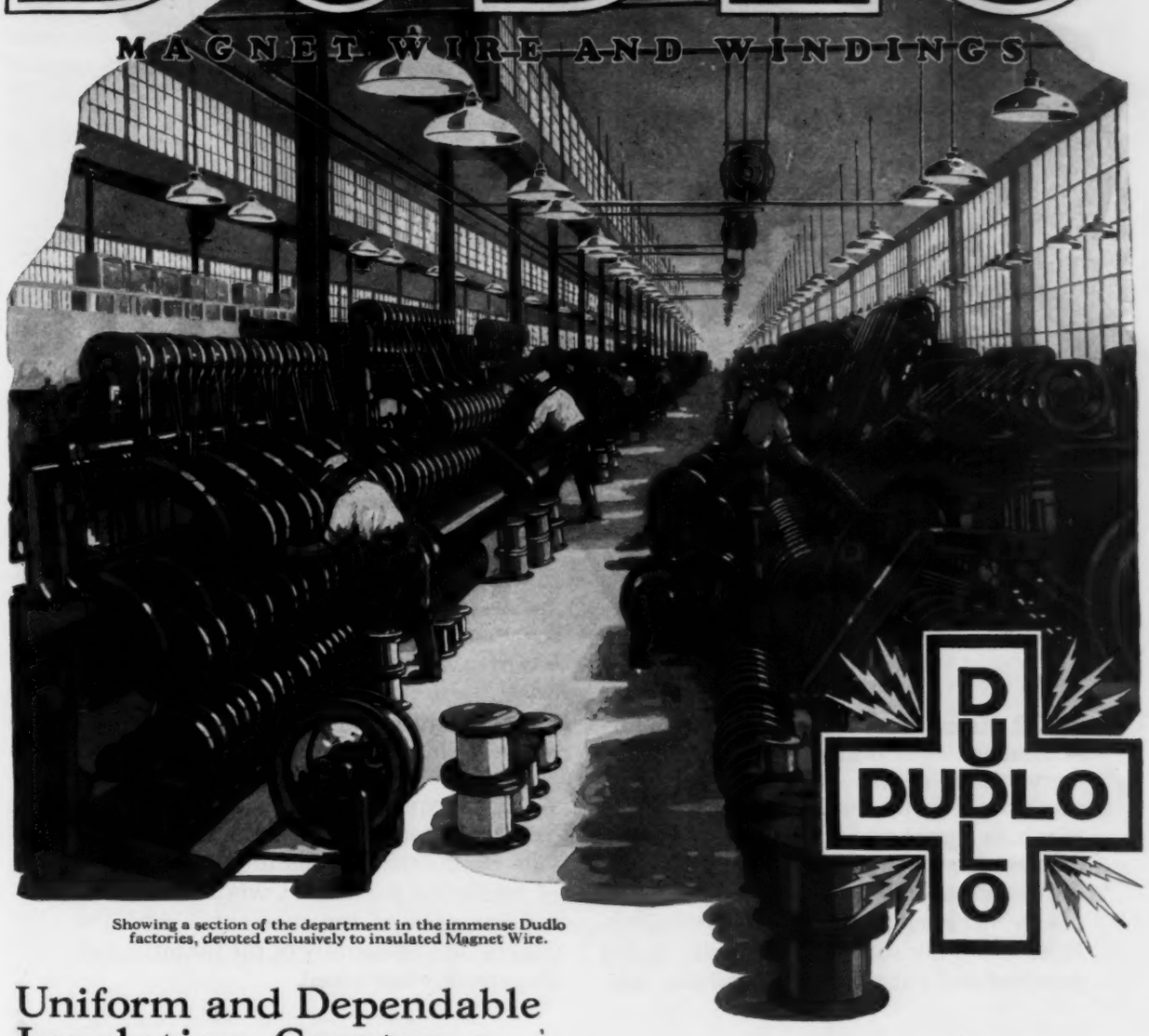
BELDEN PRODUCTS

Beldenamel and Textile Magnet Wire
Coil Windings
Beldenmold (Molded Bakelite Products)
Automotive Wires and Cables
Airplane Assemblies
Radio Wires, Cords and Cables
Rubber Covered Wires
Armored Cables
Flexible Armature Wires
Motor Lead Wires
Braided and Stranded Copper Cables
Cotton Sleeving

Specify Belden

DUDLO

MAGNET WIRE AND WINDINGS



Showing a section of the department in the immense Dudlo factories, devoted exclusively to insulated Magnet Wire.

Uniform and Dependable Insulation Creates a Preference for DUDLO Magnet Wire

Copper wire accurately drawn to gauge from pure copper rod of maximum conductivity is scientifically annealed before being insulated. ¶A smooth even coating of the finest grade enamel gives the greatest di-electric strength to the smallest possible diameter. ¶ A wrapping of cotton or silk of the highest quality, is wound tightly and closely to insure the most perfect insulation. ¶ Strict adherence to diameter is important. Where Dudlo Magnet Wire is used your winding will agree with your calculations. ¶ Specify Dudlo Wire and be certain of the best quality of copper rod, and the finest grades of insulating materials, uniformly and compactly wound.

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DIVISION OF GENERAL CABLE CORPORATION

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274 BRANNAN ST.
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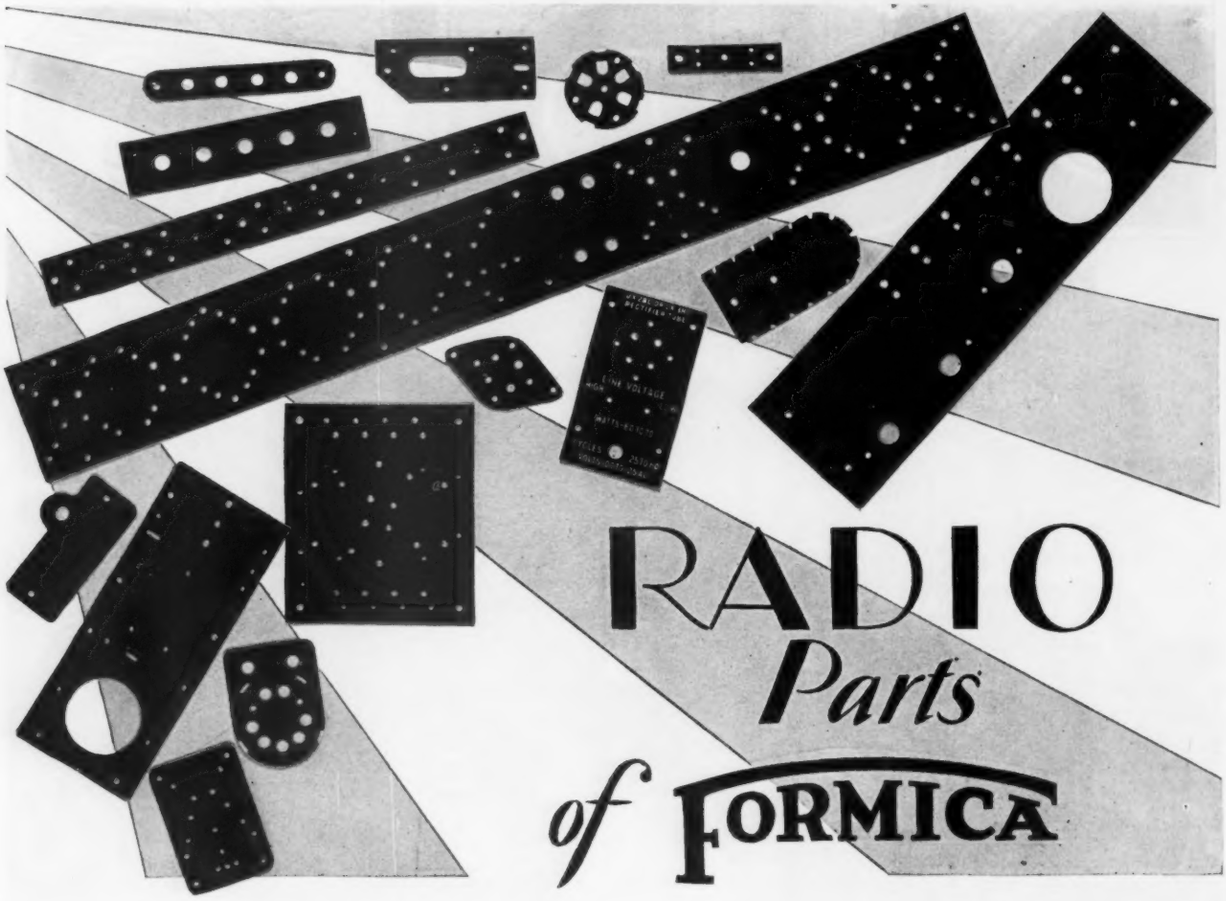

FOR fifteen years Formica has been furnished in changing forms to suit the convenience of the radio engineer and producer. In the early days it was sold in whole sheets and whole lengths of tubing and fabricated largely by hand by the radio builders. Then there were decorated front panels printed in gold and silver. Now there are sanded or threaded tubes punched and cut to length, washers, sub-panels, shelves and terminal strips - - most of them shipped all ready to assemble.

At large expense, Formica equipment has been changed from year to year to provide production in quantity at all times of insulating parts that would meet the requirements of the moment. And the quality and uniformity of the material has also steadily advanced.

THE FORMICA INSULATION COMPANY

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FORMICA

Made from Anhydrous Bakelite Resins

SHEETS TUBES RODS

Electrical Manufacturing

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Prosperity and High Wages

By E. G. GRACE

President, Bethlehem Steel Corporation

"AMERICAN industry faces no more important task today than to protect the buying power represented by wages. A new order has been created in our economic life. It is recognized first, that high standards of living are based on the greater earning power of labor, and second, that continued prosperity and high wages go hand-in-hand.

"Progressive industrial management seeks, therefore, to enable employees to earn wages as high as can be paid. Even when profits decline and business falls off, efforts are made to economize in other ways than by cutting wages. But high wages can be paid only as long as economic conditions permit them to be paid.

"One of the chief factors affecting this ability to pay them is foreign competition. With European wages far below American wages, and consequently production costs lower, European manufacturers can compete on equal terms with the products of higher paid American labor.

"Naturally, we are all interested in European progress, but foreign standards can be raised without reducing ours. Responsibility in part for protecting his wages rests upon the individual, both as an employee and as a citizen. As a wage earner, his responsibility is to help increase production and reduce costs, so that his own company can meet competition."

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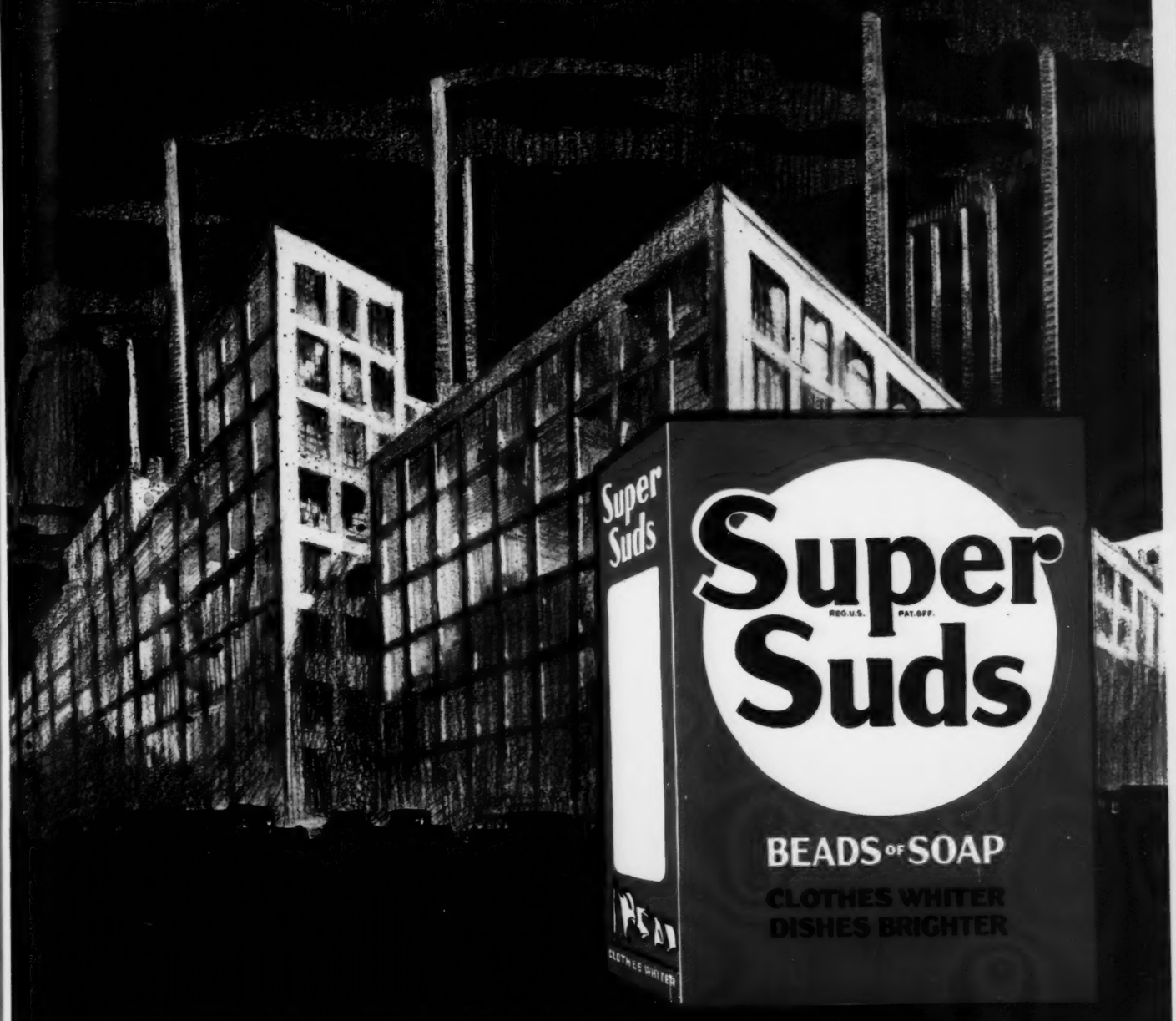
GAIR FOLDING CARTONS



The tremendous production forces behind Gair Folding Cartons account for their extensive use by the largest packers of branded merchandise.

Gair Mills turn out over one thousand tons of box board a day—box board that flows like a band from our Paper Machines through our self-contained Finishing Plants, where all elements of Folding Carton and Corrugated Case manufacture are controlled from the ground up.

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We loved our old professor, with his necktie swerving toward his ear, in private, but he abashed us a little in public. External negligence brings doubt upon hidden merit, and a badly chosen color or an unskilled display of lettering on a Carton can defeat every effort to popularize good merchandise.

The use of color — we mean its variations in tints and shades, in which red is given a new brilliance, blue more power and brown an individualizing opulence — is not a haphazard matter. Art and feeling enter into it. Printing and lithographing presses maintain it, and the Public responds to its appeal with certainty providing the Carton gets life through its correct use.

Sixty-five years of study and experience in the manufacture of Gair Folding Cartons is our greatest asset. We have run the gamut and acquired the instinct with which to foresee the effects that will react on the restless desires of the times.

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420 LEXINGTON AVENUE, NEW YORK CITY

"HANDY" Silver Solders in Electrical Work

It is now generally recognized that there are a multitude of manufacturing and assembling operations in the electrical crafts, in which the use of silver solders will both speed up production and produce better finished work.

General Characteristics

"Handy" solders containing silver in combination with copper or zinc, or both, have the following admirable characteristics for electrical work:

1. **High conductivity**—increasing with the percentage of silver contained in the solder.
2. **Strength.** Cast test-bars of "Handy" silver solders show 40,000 to 60,000 lbs. per sq. in. tensile strength—varying with the composition. Silver-soldered joints are frequently stronger than the metals joined.
3. **Toughness—Malleability.** Vital in joints that must withstand vibration or occasional shock or stress—as for instance in automobile and airplane parts.
4. **Free-flowing properties.** "Handy" silver solders, when fluid, flow instantly and have remarkable penetration. This free-flowing property adapts them admirably to rapid, automatic quantity-production in which the work passes on a carrier, or round a spindle, through the soldering flame. It also speeds up production in hand-soldering work.
5. **Homogeneity.** Silver-solder joints, when properly made, are free from pits, laminations, pinholes, or other structural defects. This has important bearing upon both their permanence and their conductivity—as well as their leak-tightness for liquids or gases.
6. **Low Flowing Temperature.** Especially useful in soldering copper, extruded brass and high brass. Copper is a rapid heat-conductor and heat applied at a joint is quickly carried away. "Handy" silver solder, flowing at 1325° to 1600°F. meets this condition ideally. It is the only "hard" solder that can be successfully used with thin sections of extruded brass, which itself, melts at 1580°F.
7. **Versatility.** The fact that silver solder makes strong permanent joints with—

Steel	**Bronze**
Monel Metal	**Brass**
Copper	**Sterling Silver**
Nickel Silver	**Extruded Brass**

Or their combinations.

—fits it for a wide range of electrical operations.

Only 12 Standard Formulas

A protracted campaign of laboratory and shop tests has enabled us to reduce Handy Silver Solders to **twelve** tested, standardized mixtures—instead of the **hundreds** of formulas which were formerly used. These twelve mixtures range from 10% silver to 80%. Each is given its key-letter designation, and the uniformity of the chemical analysis and physical characteristics of each is definitely guaranteed.

These solders are furnished in the form of sheet, strip, wire and filings.

We Co-operate—Fully

In order to determine which of our "Handy" silver solders is best adapted to any particular kind of work, we invite you to send us samples of parts to be soldered. Our metallurgists will make special tests, if advisable, and give you suggestions.

Our Handy Silver Solder Book "E" is an authoritative text book on silver-soldering. Full of practical ideas. Send for one.

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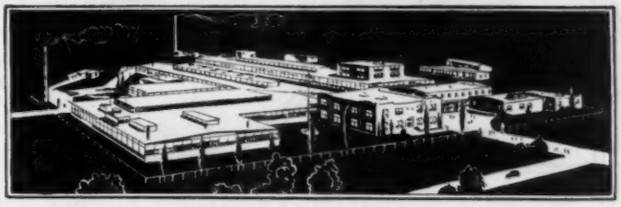

No. 112 W. B. Adjustable Legged Stool

Economical, fire resisting, and sanitary. Your investment in ANGLE STEEL is a wise one. We build special equipment according to your specifications. Ask for our new 112 page catalog of complete buyers information on up-to-the-minute steel equipment.

If it's ANGLE STEEL it's Long-lasting, Profit-making Equipment!

UNCORK the works—lift the cover off your factory, and see those many places and opportunities to increase production and profits.

Notice that man over there in the corner—look at his position—see how *just one* ANGLE STEEL STOOL would help him in his work?

Now look around further—and you will find scores of places where a single piece of ANGLE STEEL EQUIPMENT would work wonders.

You will find ANGLE STEEL EQUIPMENT a time defying investment. It possesses a large reserve of strength. Produced to withstand the hard usage of the average employee—and meet it year after year. Designed for comfort and efficiency also, it helps to counteract that "3 o'clock fatigue." In other words it helps to increase production and increase profits.

Whether you purchase ANGLE STEEL chairs, benches, tables, stools, desks, cabinets, machine tenders, trucks, bench legs, or any of the dozen other leading items—you are actually making an investment in increased profits.

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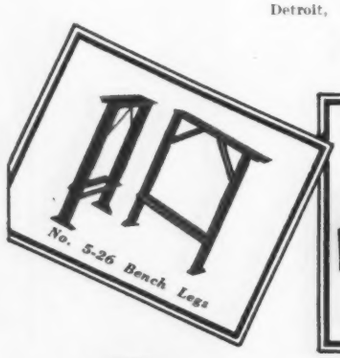

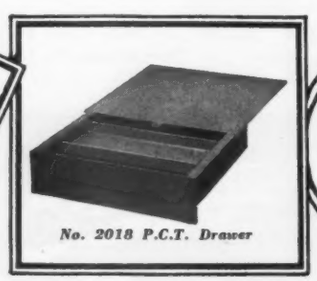

No. 2018 P.C.T. Drawer

No. 1018 Chair

No. 29 Desk

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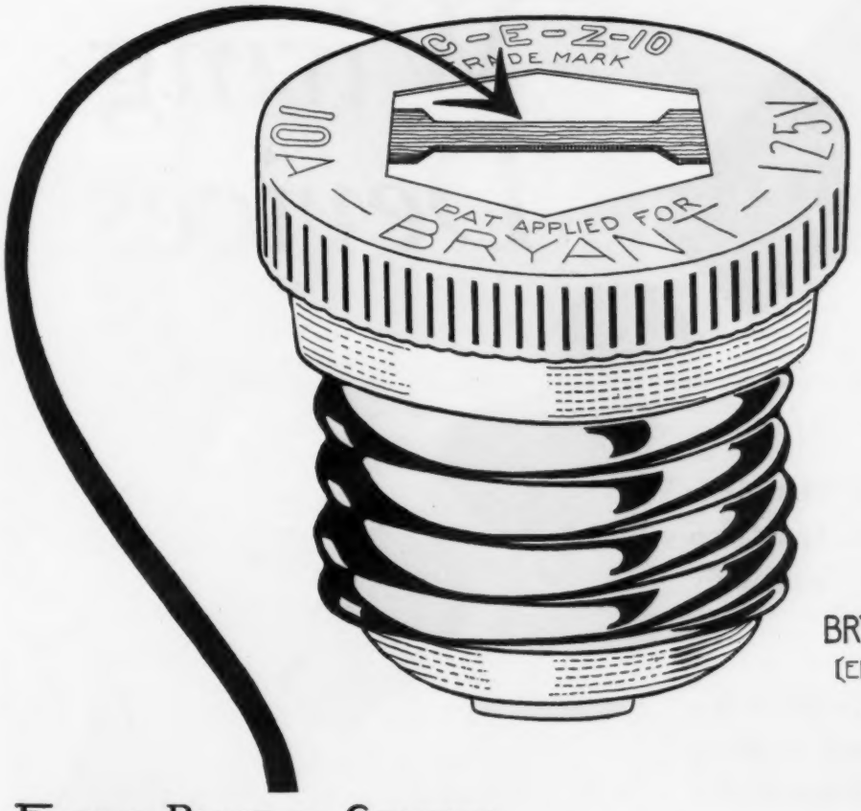
ECONOMICAL - SANITARY - DURABLE

BRYANT SUPERIO WIRING DEV

PYROTITE FUSE PLUGS

with the C-E-Z-10 Cap!

[See Easy]



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The "big things" with us are *doing every job correctly* and retaining the good will and confidence of our clients.

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you'll find it helpful if you are designing *a New Product* or improving *an Old one..*

Are you in the midst of designing a new product and wondering about the heating unit—what's the right size, type and rating? Or are you ironing out the rough spots in an otherwise good electrical appliance or some equipment, that would be a "best seller" if only the heating unit were what it should be?

★ *Then you'll want a copy*

In it are priced and pictured the many sizes of Chromalox heating units being built into the electrically heated products of over 60 leading manufacturers of appliances . . . ranges . . . hotel and restaurant equipment . . . industrial equipment.

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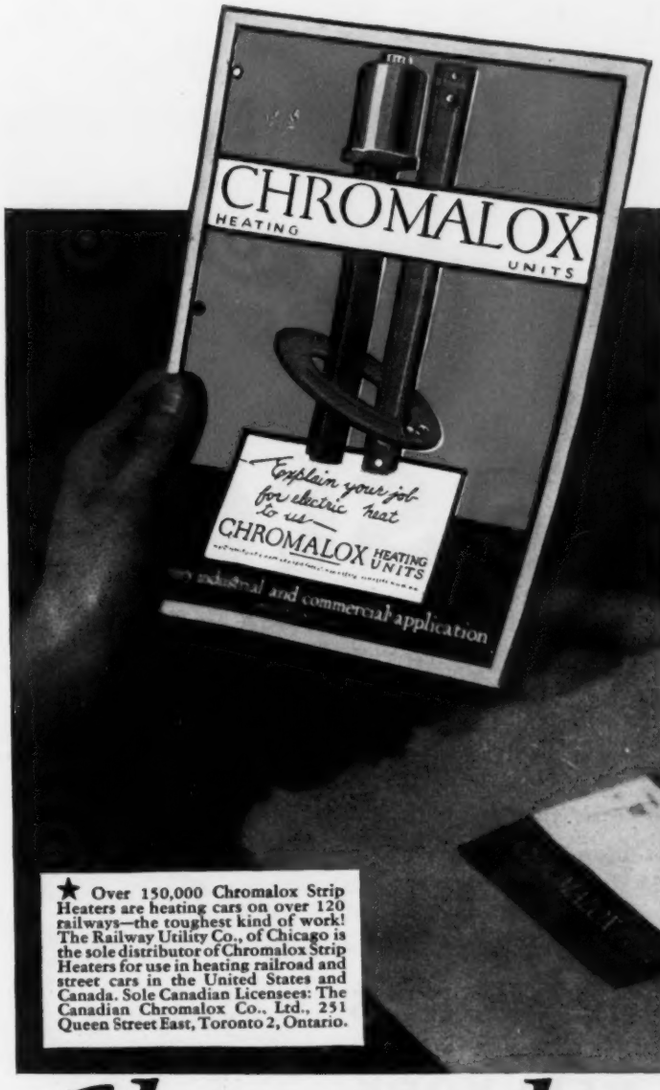
Each of the manufacturers with whom we have worked have saved time and money in costly experiments, both with their products—and with *their customers.* Most of them called us in to help with the final design of their product. In all instances, we showed them the *right* way of building heating units into their products so that their products would *stay sold.*

★ *But what about your products?*

Tell us about your developments. No doubt we could do some helpful things for you as we have done for dozens of other manufacturers. It's surely worth considering. Mail the coupon now for your copy of this 8-page booklet—telling us about the appliances or equipment you want properly heated. There's no obligation.



★ Over 150,000 Chromalox Strip Heaters are heating cars on over 120 railways—the toughest kind of work! The Railway Utility Co., of Chicago is the sole distributor of Chromalox Strip Heaters for use in heating railroad and street cars in the United States and Canada. Sole Canadian Licensees: The Canadian Chromalox Co., Ltd., 251 Queen Street East, Toronto 2, Ontario.

Chromalox
ELECTRIC HEATING UNITS

★ *. . . mail with your letterhead!*

Elec. Mfg. 11-28

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YES, without obligation, send me a copy of this Chromalox bulletin and any other data that will help me determine what heating units should be used for

heating a _____

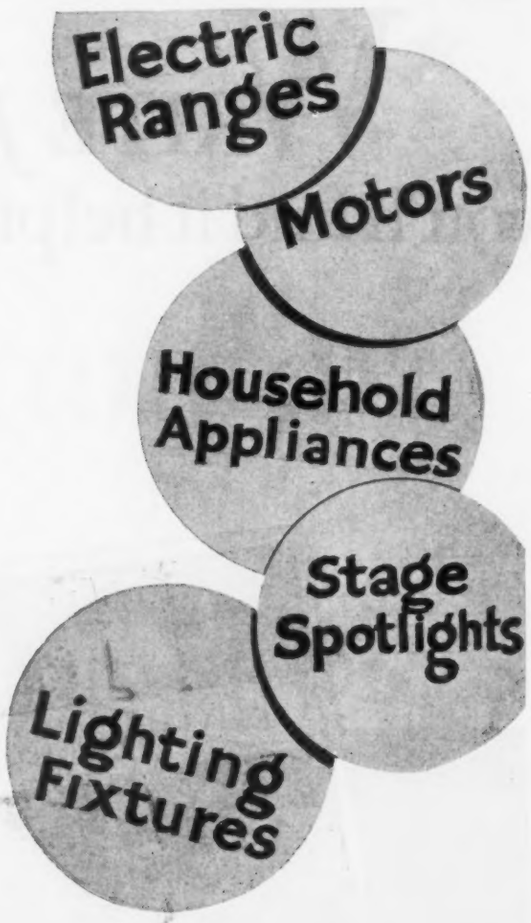
_____

_____

Signed _____ *Position* _____

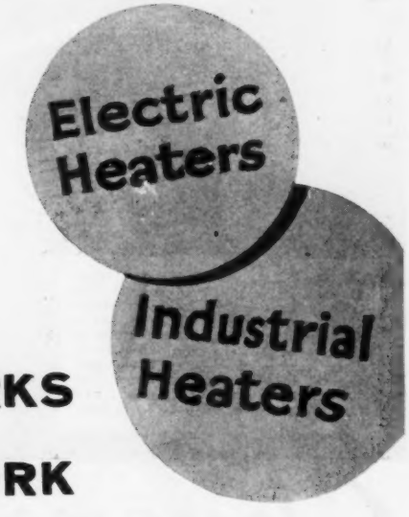
(PLEASE WRITE PLAINLY)

THE WIRE WITH THE LONG ASBESTOS FIBRE



Deltabeston

The tough, long fibre asbestos covering of Deltabeston makes it the ideal protection from the attacks of heat, twisting and general rough treatment. Deltabeston is a resilient wire that is flame-proof and practically strain-proof.



YORK INSULATED WIRE WORKS
OF GENERAL ELECTRIC CO.
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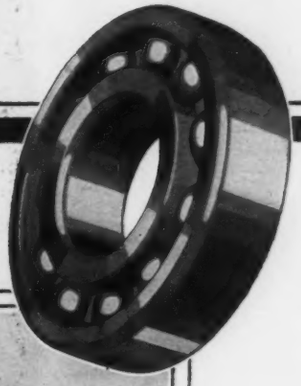
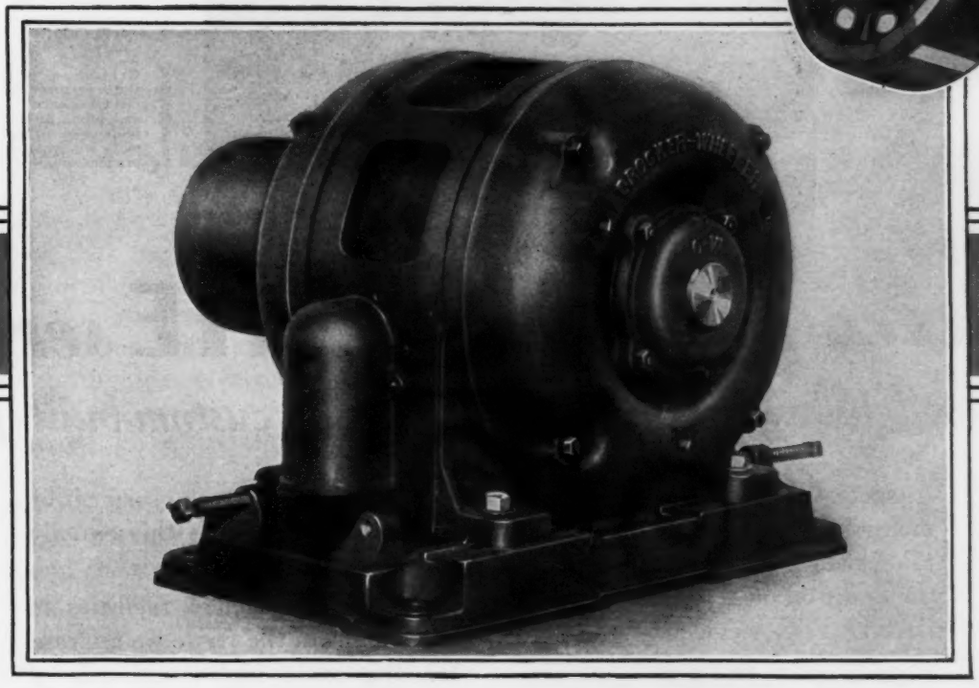
DELTABESTON WIRE

More than 50 Manufacturers of General Purpose Motors Use Ball Bearings





889

CROCKER WHEELER is one of more than fifty electric motor manufacturers who supply a series of general purpose electric motors with ball bearings as standard or optional equipment.

Motor users can not afford to overlook the economies of ball bearing equipped electric motors.

Write for "Booklet K" and "Cutting Your Cost," two publications of our Engineering Department explaining fully what these advantages are and how greatly they reduce motor maintenance costs. These are sent without cost or obligation upon your request.

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Now- a complete BAKELITE service

manned by experts in the molding of custom-built parts

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This new BAKELITE Department has been created at the urgent and repeated request of *our own customers*. Highly pleased with the intelligent service they have come to expect of us in supplying their requirements in the molding of genuine hard rubber parts, they have asked that our service be broadened to include this equally important field of plastics.

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Let us quote you on your next requirements.

The VULCANIZED RUBBER COMPANY, Inc.

Makers of Genuine BAKELITE and HARD RUBBER PRODUCTS

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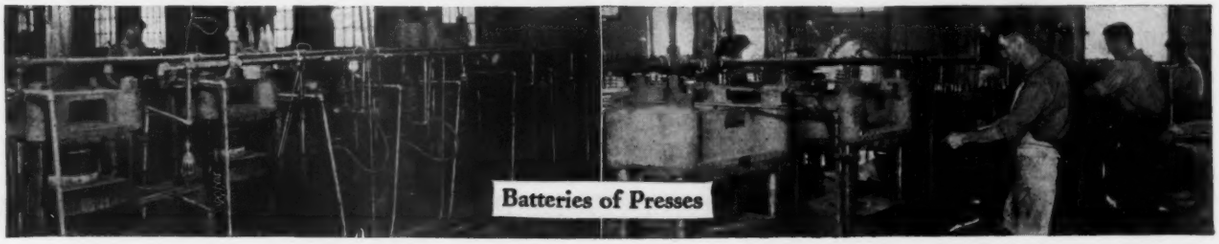

Batteries of Presses

NOV 15
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Electrical Manufacturing

Production - Marketing - Administration - Repairing

Volume 2 NOVEMBER - 1928 Number 5

SETTING A GOAL FOR BUSINESS

BY HERBERT HOOVER

THAT high and increasing standards of living and comfort should be the first of considerations in the public mind and in government needs no apology. We have long since realized that the basis of an advancing civilization must be a high and growing standard of living for all people, not for a single class; that education, food, clothing, housing, and the spreading use of what we so often term non-essentials, are the real fertilizers of the soil from which spring the finer flowers of life.

The economic development of the past fifty years has lifted the general standard of comfort far beyond the dreams of our forefathers. The only road to further advance in the standard of living is by greater invention, greater elimination of waste, greater production, and better distribution of commodities and services, for by increasing their ratio to our numbers and dividing them justly we each will have more of them.

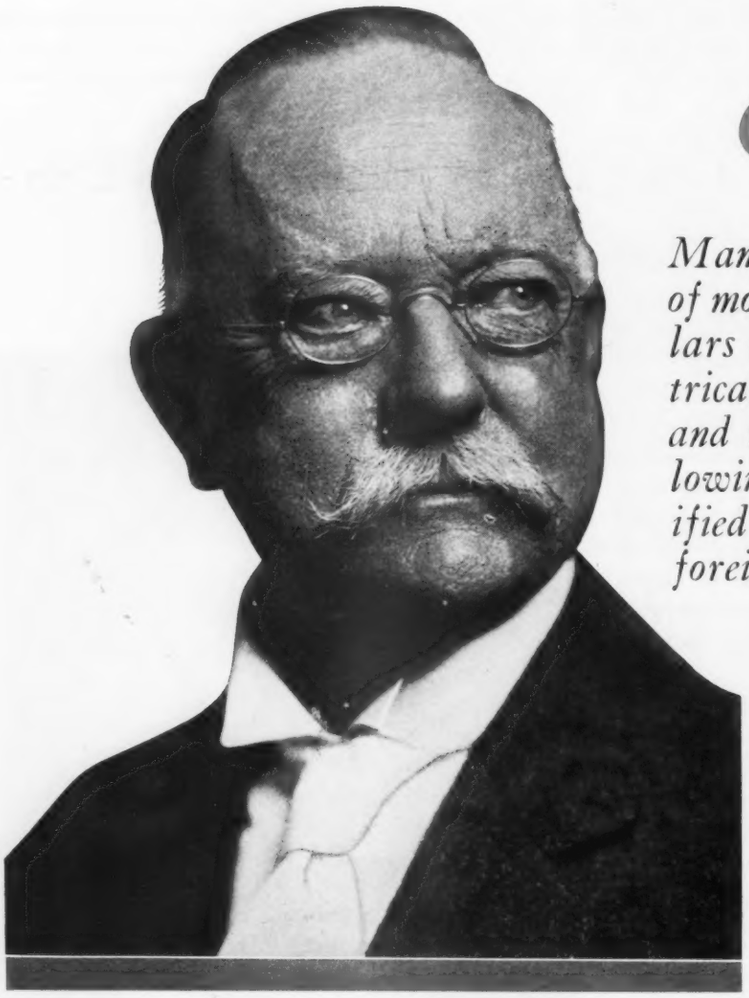
The superlative value of individualism through its impulse to production, its stimulation to invention has, so far as I know, never been denied. Criticism of it has lain in its wastes but more importantly in its failures of equitable sharing of the product. . . . While there should be no minimizing of a certain fringe of injustices in sharing the results of production, or in the wasteful use made by some of their share, there is vastly wider field for gains for all of us through cheapening the costs of production and distribution through the eliminating of their wastes and from increasing the volume of product by each and everyone doing his utmost.

From "American Individualism"
By Herbert Hoover

Herbert Hoover

President-Elect, United States of America

Electrical Equipment Success



Many conditions enter into the sale of more than a hundred million dollars worth of products of the electrical industry overseas annually and these are discussed in the following article by a man well qualified by years of experience in foreign commerce and markets.

By William C. Redfield

EXPORT trade does not differ essentially from domestic trade in its basic principles. It is not a mysterious and hazy sea in which one can navigate by dead reckoning and expect to reach port. It is a place for the same kind of applied intelligence which a man uses at home.

William C. Redfield

EVERY once in a while a voice is lifted in the political arena to tell how happy we should be that a flood of foreign products is not permitted to swamp our American industries. Strangely enough one has only to read the current trade literature of other industrial countries to find that they tell the reverse tale. The alleged flood of products of American industries flowing into their markets is a subject of constant remark. An observing traveler in the streets of great foreign cities cannot avoid seeing signs beseeching the people to buy the products of local factories. The "American invasion" is to them not an illusion, but a reality.

We need not here discuss why some among us are fearful, while those we fear are expressing dread of us. Perhaps Congressional debates may throw light upon this curious problem. Whether they do or not need not concern us deeply. Let us to our salesrooms and factories and play our part in the great game while talkers talk and orators imagine vain things. Suffice it for our present purpose to know that electrical equipment in many forms not only can be exported successfully but is exported successfully. The process goes on steadily and is enlarging. The question whether we can export electrical equipment was long ago answered in the affirmative. It remains to discuss other questions, such as how to export, what to export, and whither to export, in the strong faith that light upon these will add to the stream flowing from our factories into foreign fields.

Our Government records tell an interesting story. When this century opened our annual exports of electrical apparatus were valued at about five million dollars. They grew to ten millions; then to fifteen, and by 1912 they reached twenty millions. Steady growth followed to the record year of 1920, when the figure was one hundred and thirteen millions. Quickly came the slump and in 1922 our exports of this kind were about half of what they had been two years before; they had fallen to about fifty-eight millions. Then, the war being over and the world set to the task of rebuilding, came a growth that should give us all encouragement. Each year showed steady gain, to seventy millions, then eighty, to over ninety, and in 1927 to more than one hundred millions. The first six months of 1928 show an increase of four million dollars over the same period of the previous year. Not only so, but the sales were distributed over eighty different classes of electrical machinery and apparatus, some of which showed an absolute gain over the record year of 1920. Export trade of this

CAN BE EXPORTED FULLY

kind not only can be done, it is done: the real question is how shall we do more of it. We may remind ourselves here that international electric companies already exist and that American interests in foreign electric corporations, now considerable, are expanding. No little part, therefore, of our export trade in electrical equipment is done with friends.

An English electrical engineer, writing within the present year concerning Britain's export electrical trade, says something which has value for us. His words are, "It is generally assumed that low prices are the principal attribute of export trade, but that view is only superficially correct. When export trade is obtained at cut-throat prices it is of no value in itself and it is worse than valueless from the point of view of business building." He then reminds his readers (and ourselves) that in some large markets there are laws on the subject of price-cutting which it is well to remember. No, the way to export successfully is not to do it by cutting prices to the bone. Price competition is often a sign of industrial weakness. It is poor tactics in a field which requires far-seeing strategy.

Before, however, we part with this subject of low prices, let us talk frankly together for a little about it. Do you who read this always buy the cheapest thing of the kind you want? Do you never consider whether something other than the lowest priced article is better suited to your purpose, whether in design or lasting quality or in convenience of use it is not on the whole more economical? Do you always buy the cheapest shoe and lowest priced hat and the suit of clothes that is offered for the least money? Does any intelligent buyer limit himself to the article offered at the smallest figure? Is it always and everywhere economy? On the whole, men in other countries are not in fundamental things so very unlike ourselves. There are plenty of them who want a good article, some who want the best article, others want that which happens to please them, or that which suits their particular necessities. For example, in Java there are many isolated plantations supplied with electric power. The climate is hot. Germany and Sweden have seen the point and are doing rather well in furnishing small refrigeration sets. They suit the conditions and so make an appeal to buyers which is not wholly a matter of price but one of comfort and availability and usefulness.

¶ It is quite generally agreed that his adaptability and his willingness to study what his customer needs distinguishes the American manufacturer from his competitor.

THE writer was once faced in Belgium with a quotation from German sources which was 20 per cent less than his own price. The goods were of a character on which in use a man's life might at times depend. His answer to the lower price offered was the question, "Will you venture to use that tool when you can get mine?" And the buyer admitted that he would not so venture.

WILLIAM C. REDFIELD was born in Albany, N. Y., June 18, 1858, and received his education in the schools of Pittsfield, Mass. During a long business career he has held the following offices: treasurer J. H. Williams & Company, Brooklyn, 1887-1901; vice-president Warp Twisting-In Machine Company, 1904; president J. H. Williams & Company, 1905, and Sirocco Engineering Company, 1907-1911; vice-president American Blower Company, 1909-1913; director Equitable Life Assurance Society, 1905-1913; He served as Commissioner of Public Works, Borough of Brooklyn, 1902-1903; and was elected as a democrat to the Sixty-Second Congress (March 4, 1911-March 3, 1913). In 1915 he was appointed Secretary of Commerce by President Wilson and served in that capacity until November 1, 1919, when he resigned. He is also a former president of the following organizations: American Manufacturers' Export Association, two terms, Society for the Promotion of Industrial Education, American-Russian Chamber of Commerce, Netherlands Chamber of Commerce in New York, Netherland-American Foundation, and Danish-American Corporation. Mr. Redfield is a director of the Brooklyn Chamber of Commerce, a member of the American Committee of the International Chamber of Commerce and of the Foreign Commerce Department Advisory Committee of the Chamber of Commerce of the United States, and is president of the National Institute of Social Sciences. His home is at 37 Monroe Place, Brooklyn, N. Y., and his business office is at 280 Madison Avenue, New York City. Mr. Redfield is the author of a number of books: "The New Industrial Day," 1912; "With Congress and Cabinet," 1924; "Dependent America," 1926; and "We and the World," 1927

Few, if any fields provide the varied opportunity for competition in design, quality and service, which is permitted, indeed encourage, by the very character of the electric equipment industry itself. From its nature it has possibilities denied to others. It can make adjustments in one way to the needs of one country and in another way to the requirements of a different land. In this arena of design and adaptation with sustained quality lies the hope, nay, the opportunity, for the export trade of the electrical industry. Well-informed men throughout the world agree that the American manufacturerer has one quality which distinguishes him generally from his competitors. It is his adaptability, his willingness to study what his customer needs and make it for him. An example will illustrate. An American factory was making a tool common in every machine shop in this country, called lathe dogs. They use lathe dogs in Great Britain, or, as they call them, "carriers," but they are not the same breed of dog. Our lathe dog has a bent tail; the British dog has a straight tail.

This American manufacturer observed in going about English factories that the English lathe carriers (or dogs) were not alike. There was no standard line of the tools there and such as they had were ill-designed, of haphazard shapes. He found on inquiry that the English users would be glad to have a standard lathe carrier but none was in the market. He proceeded to have designed for American manufacture and British use a standard line of lathe carriers suited to the English market. Samples were made, submitted, approved, and when the goods were actually offered in the British market the salesman who showed them took an order from every man to whom he offered them. They were all but unsalable in the United States but it seemed a good idea to make in an American factory an article which had a good sale in the English market.

¶ The electrical industry from its nature has possibilities denied to others. It can make adjustments in many different ways to meet the needs of almost any country

THIS thought is emphasized by the English engineer to which reference was made previously, for he admits the loss to Britain of Canadian electrical trade, saying: "She is dominated by U. S. A. designs and practice." This, then, is the core of the whole matter. Goods well designed and carefully made, adapted to the needs of the customer, are already half sold.

Right here, however, a word of caution lest that be done from which many of our fellows have suffered. The export field is no place for occasional excursions. It is not an arena in which it is safe to enter to get rid of surplus stocks or even for the purpose of utilizing excess capacity unless that capacity is to be used with intelligent adjustment to the market sought. On the other hand, export trade does not differ essentially from domestic trade in its basic principles. It is not a mysterious and hazy sea in which one can navigate by dead reckoning and expect to reach port. It is a place for the same kind of applied intelligence which a business man uses successfully at home.

Since it appears, then, that electrical apparatus is already moving successfully and increasing in the export field and that its nature is such that it can adapt itself flexibly to the varying needs of differing markets and to almost every phase of domestic and industrial life, let us now consider some questions which may normally arise among those to whom this field is as yet unfamiliar. It is understood in this part of our discussion that the manufacturer has reached the conclusion that export trade can be done and is prepared to take it up thoughtfully as a regular part of his business movement. Now he seeks to know what the opportunities are, where they are, and what he should learn in order to take advantage of them. He will, of course, use his good common sense. He will not try to sell electrical heaters in Sumatra but for the same reason that forbids this he may consider whether electrical cooking apparatus might not find some market where heat is excessive and heaters superfluous.

¶ In New York City there are twenty-five foreign chambers of commerce, each of them eager to inform inquirers about business opportunities in foreign lands

IN the City of New York are twenty-five foreign chambers of commerce, each of them eager to inform inquirers about business opportunities in the lands they respectively represent, each of them willing to give or obtain definite answers to direct questions. Furthermore, many countries maintain trade commissioners in New York or Washington and these chambers of commerce all know about them. The Bureau of Foreign and Domestic Commerce of the Department of Commerce is a treasure-house of information. Its men—its experienced and practical men—are located in many parts of the world and the purpose of their existence is to be the guide, counsellor and friend to the American exporter. Such bodies as the National Foreign Trade Council, the American Manufacturers Export Association, the American Exporters and Importers Association, the Chamber of Commerce of the United States, and the International Chamber of Commerce, are willing servants of American trade, and the consulates of foreign lands in our chief cities are ready to cooperate. The Department of Commerce furnishes specific studies on the markets for electrical machinery and supplies in many countries through its Electrical Equipment Division. These tell with a good deal of precision just what is being done in specific markets by our competitors and ourselves, what the needs of those markets are, and how to meet them. They cover such points as the existing developments of electrical power and the future possibilities thereof, the progress and present state of domestic electrification and wiring, electrical transportation and communication, and the local regulations which apply to the use of electricity together with duties and the business methods of the country. Tables are given of all exports of electrical equipment both by products and countries. These Trade Information Bulletins, as they are called, appear frequently and form a mine of knowledge into which the inquirer would do well to dig to determine the worth of the foreign markets.

¶ The Bureau of Foreign and Domestic Commerce is a treasure-house of information. Its men are located in many parts of the world to counsel American exporters

IT is certainly the case that no such amount of formulated information exists respecting our domestic trade possibilities as is offered about foreign fields. In utilizing these official and unofficial sources, all of them responsible, one may find at the beginning as much as he can readily digest. It remains to make use of it. One or more of these sources may, and sometimes will, go so far as to tell him whom he should address in the particular fields they respectively cover. They will suggest to him from whom and how he may ascertain what that market wants. Some of them will be eager to tell him of opportunities which are not yet met. If the funds available do not permit sending a representative abroad the would-be exporter may learn by special inquiry, sent through the Bureau of Foreign and Domestic Commerce to its own men on the spot, what form of appeal to buyers in those lands would be most effective. From the same source he would also learn much to guide him on the question of price as well as on the more important factors of design, quality and adaptation to local needs.

It is, of course, desirable, if it is possible, that the American manufacturer should add to the information available here by personal studies on the spot. There is nothing like the intimate, individual touch. It is probably that he will need a foreign representative and the selection of one is a matter of decisive importance. It does not differ in principle, however, from the selection of an agent in San Francisco or El Paso. The houses of established reputation in every foreign field are well-known to one or more of the sources already mentioned and if the would-be exporter cannot go himself or send from here a confidential representative he may find without serious risk, by checking various sources of information against one another, the houses with which it is safe to negotiate.

The question of foreign credits need not be a dangerous

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Systematic Planning for Production Control

Gearing production to sales enabled the Grigsby-Grunow Company to change products without loss of production time

By Leon I. Thomas

THE nearest thing to war-time activity that I have seen since those busy days of 1918 is taking place out on the northwest side of Chicago. It is at the plants of the Grigsby-Grunow Company, makers of Majestic radio receivers. And incidentally one of the bee-hives there is the large plant which this concern acquired from the Yellow Cab Manufacturing Company in which now only radio cabinets are made. In all, the Grigsby-Grunow Company is now using approximately a half million square feet of floor space.

But there are busy plants and busy plants. What makes this company's operations stand out as worthy of relating is mainly, from a plant executive's viewpoint; the policy of gaging production not approximately, but exactly to market demand. And along with it is a most remarkable system of inspection so arranged that even 25 cents may not be spent on a set before any error is caught. Inspection is that frequent and rigid.

There are other points of managerial interest, such for instance as wage payment methods, but the two mentioned are the most outstanding and form the nucleus around which the following is constructed.

Perhaps a paragraph or so can be well spent in outlining some of the previous accomplishments of this company simply to give a background against which to project present application of policies which have been adhered to all along.

It was only three years ago that the company, then known as the Grigsby-Grunow-Hinds Company, started the manufacture of radio products. They entered the radio field as makers of what then had the commonly applied but unhappy name of loud speakers. The next step after

making reproducers was "B" power units. Then a year ago last summer they made an "A" unit. In April of this year the company brought out its line of A. C. receivers.

Now, throughout this development this concern has adhered to the policy of high quality at the lowest possible prices, which as every factory manager knows, means volume business. Also, throughout this development was followed the policy of closely gearing production to sales. So well was production gaged that when they stopped manufacturing socket power units in the middle of March they had only two days production on hand.

So much for background. Today under a daily output of from 3200 to 3500 receiving sets there is just as close a gaging of production to sales demand as formerly. There is not a finished set in stock nor would there be at any time even if demand should suddenly fall off. The method of operation and control does not permit of it.

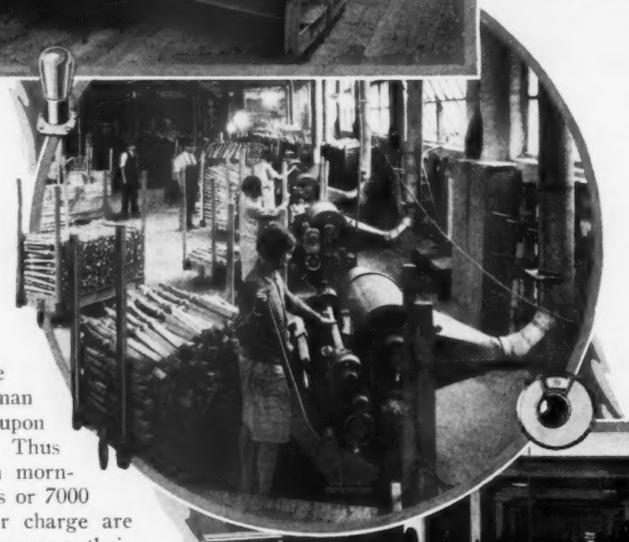
Every night quotas are made up for each foreman for the next day, based upon the day's sales reports. Thus the foremen know each morning that, say 3500 of this or 7000 of that part under their charge are needed, and they can arrange their lines accordingly. Daily total quotas are then quickly converted into hourly output necessary, and this is watched closely from hour to hour. Any failure on the part of any department to come up to predetermined hourly output is immediately reported to a production executive who sees to it that in the next hour the loss in the previous one is made up.

In other words shortcomings in production volume are not allowed to accumulate from hour to hour or even to remain as shortcomings. If a certain group has a quota let us say of 2500 for the day, noon should see 1250 of them finished. If more than a day goes by where quotas have not been met the foremen concerned are hailed to the office for an explanation. Nor is this as harsh or arbitrary as it may sound in the telling, for the whole thing is intelligently done. The workmen themselves, for example, know at the start of the day what their quotas are, so they can gage their efforts accordingly. Thus they go at their work not at all blindly.

The impossible is never asked. The quotas set are always attainable. That's one of the reasons the plan works out so well. If what is asked for cannot be accomplished by the force on the job, more people are hired. And if the space available is so limited that more people cannot be put on, machinery is moved or other rearranging is done to provide more adequate facilities for doing the required amount of work thoroughly and with dispatch.

In other words, quota production from day to day is the ultimate goal for which everyone strives, and around which everything revolves. But, you will say, there has got to be some flexible link somewhere if you make output so elastic as to respond daily to sales demand, and that link appears to be labor. The answer is that it is. How then, you will further inquire, can people be held if the production schedule happens to require a frequent laying off of labor.

This latter query might raise a serious question were it not for one important factor in the Grigsby-Grunow policy, and that is



AT the left, above, is shown the transformer assembly section of the Grigsby-Grunow Company's plant in Chicago. The machines illustrated at the left are capable of turning out one console leg every 20 seconds. Below is shown the chassis assembly section of the plant. The system used by this company makes production activity correspond, not approximately but exactly, to the market demand or the sales department orders

GLUING operations in the assembly of the cabinets are handled as shown at the left. There is never a finished set in stock because daily schedules are maintained

that the labor is on a piecework basis and the rates are high—considerably higher than in other plants for the same kind of work.

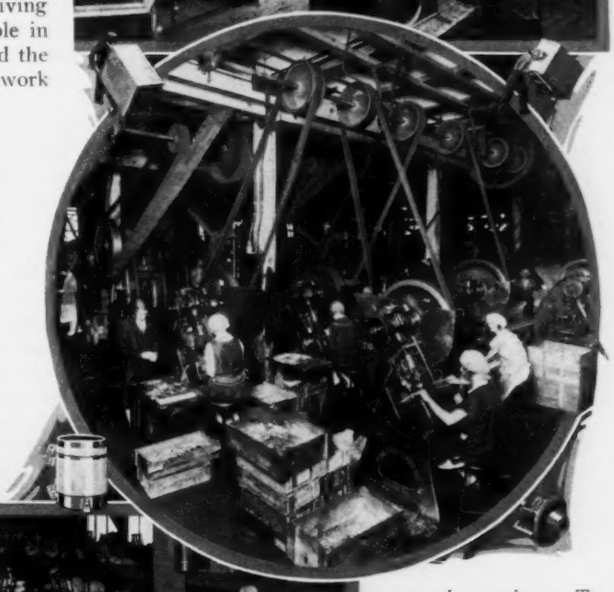
Also the work is so subdivided that each person does only a single operation or two, and may be relatively quickly trained in it. In this latter connection it is interesting to note the training methods. New people are trained thoroughly before they are put at their tasks by competent supervisors who know the work and who know intensive production from every angle.

Not only is the pay high but this word goes out and makes the task of hiring skilled labor fairly simple.

Another interesting thing is that most of the employees work in groups of two. This then amounts to group piece work with all the benefits of this system such, for instance, as the automatic weeding out of the inefficient.

An ingenious method has been devised for working this out in practice so as to secure the utmost of simplicity. As the men finish a piece or a lot they signal that fact to a checker by giving their number. Now, the two people in a group have the same number and the pay called for by the amount of work turned in against that number is divided equally between them.

A SECTION of the plant devoted to coil winding is shown above, and at the left is illustrated the room in which the Model No. 71 cabinet is assembled. All of the parts-making is done on a piecework basis



MAKING of variable condenser plates and transformer punchings, as shown at the right and below respectively, is watched closely during the day to see that the required number of parts are produced as called for in the orders which are made up for the foremen every night. Inspection is so frequent and rigid that it is practically impossible for an error to be made. Workmen are instructed to gage accurately the day's work to be done

Another point that should be mentioned is that since the compensation is on a piecework basis and since the quota is the goal, the men are free to go home when the day's quota is finished. So it happens that workers take a real pride in having their department stand out ahead of some other department, and finishing quotas as soon as possible.

Still another point of note from a personnel angle is that foremen and other department heads are "home grown." Almost never does the company go outside for its managerial skill. Naturally a following of this policy is a powerful factor in building a loyal personnel.

An important element in the highly successful operations of the company is the inspection policy. So frequent are inspections that things have little chance to go wrong before they are caught. Thus, having an entirely finished product rejected because of some faulty part made early in the sequence of operations is a thing unknown at this plant.

The reason is that every third operation is an inspection. To accomplish this, quite naturally it takes a large inspection force. Of the approximate 6000 employees, 600 of them are inspectors. Thus, quality is absolutely under control at all times just as is quantity.

Similarly the number of allowable rejects is under close control. This is made a matter of quotas just as much as is production volume. For example, rejects must never exceed one half of one per cent. That is the dead line. Should they exceed this figure, that is the signal to bend all efforts to get at the seat of the difficulty immediately and rectify it.

Extra frequent inspection is the second high spot made possible by one inspector to every ten employees. Thus quality is as much a matter of close control as is production volume. It is freely admitted that the flexible factor—the one that comes and goes with fluctuation in sales demand—is labor, but any irregularity in employment is said to be more than offset by the unusually high rate of pay, so that the net to the employee is considerably greater than in other plants having work of a similar nature. That higher wage rates are possible is in turn due to the efficiencies which coordinated policies make possible.

Adequate Tariff for Electrical Products

Manufacturers are urged to prepare data on the labor and material costs of their products, for the consideration of the next Congress

By Thomas Allen

President, Macallen Company, Boston, Chairman, Nema Tariff Committee

FROM time to time the question of the tariff has been brought before this association, and prior to the 1922 Tariff Act this organization's tariff committee studied the situation, and after a careful analysis of all the then existing conditions it was decided that, instead of asking for a separate schedule or separate paragraphs in the Tariff Act, most of the products in the electrical industry could be classified in various schedules and in certain general paragraphs.

Since the enactment, conditions have changed somewhat, and we are now confronted with the fact that probably the next Congress will undertake a revision of the existing tariff. With the Nema tariff committee's experience, it has become evident that, if the electrical manufacturing industry desires to have an adequate tariff on electrical products, this tariff committee will have to have the wholehearted support of each branch of the electrical manufacturing industry which believes it necessary to have proper tariff protection for the products it manufactures.

Thomas Allen

The tariff is a much-discussed subject, and it is generally handled in a very academic way, many people feeling that it is simply the football of politics or a local issue. While this may be true to a certain extent, and in view of a recent recommendation to abolish the Tariff Commission so that the tariff hereafter shall be solely in the hands of Congress and the President, it may be to a considerable extent, yet the tariff is of enormous importance to the economic structure of our country and of our individual businesses.

I desire to outline some phases of the tariff work and to point out what is necessary if this particular division of the electrical industry desires to take part in the tariff revision.

Why is there a tariff?

First, the general reason given for a tariff is to protect infant industries. This was necessary many years ago in connection with most of our industries; but today many of our industries have passed the infant stage, although there are quite a number still in that stage which need protection for good reasons.

The second reason for a protective tariff—and one which is vital to us at the present time—is that we may maintain the high standards of living in this country, compared with the standards of living in other countries where the rates of wages are low in comparison with ours. This is very important at the present time both to the manufacturer and to the worker.

There is another reason for the tariff, which however is used mostly by other countries, namely, a tariff for trading purposes or for preferred treatment by various nations. This form of tariff is used in such countries as Australia, New Zealand and many others. Where the tariff is used for this purpose, there are three or four rates of tariff applicable to the trade relations between various countries.

Our own tariff laws have provisions whereby, if any nation discriminates against us in tariff, we can discriminate against it so that, if any of our manufacturers contemplate or are doing export business, the tariff not only of our own country but of the foreign countries is of vital importance to them.

There are two bases for assessing duties, the specific and the ad valorem.

Under the specific basis a definite amount per unit is assessed. For instance, on importations of certain ore, it might be a definite amount of tariff per ton or per unit imported.

Under the ad valorem basis, it is a percentage of the cost of the product, such as 20, 40 or 50 per cent of the sales price of the article. In assessing duties on an ad valorem basis, there are two systems for evaluating—

1—That most commonly used throughout our Tariff Act of 1922 is known as the foreign valuation basis. Under this, the wholesale market value of the product in the country of origin is taken as the basis on which to assess the duty. Almost all of the products being imported which affect the electrical manufacturing industry come in under this basis. This method of valuation has caused a great deal of trouble, because for obvious reasons it is very difficult in many instances to find the wholesale market value in the country of origin. In many cases of material imported into this country there is no such wholesale value, and then it becomes necessary for the government to determine the cost of production in the country of origin, adding certain amounts for profit, shipping, insurance, etc. This of necessity has to be done by getting the costs of the foreign manufacturers, who object to it, and constantly differences of opinion arise as to what the real costs or values are in the country of origin.

2—The other form of valuation, which it is contended is

the most equitable and should be the proper basis for all tariff legislation, is known as the American valuation. The very first tariff act was entirely on this basis. In the second tariff act it was changed to the foreign valuation, it is believed largely at the instigation of the importers.

The American valuation system has for its basis the wholesale market value of the material in the United States. It will be seen that this can be readily ascertained, whether similar goods are made in this country or not, and it is the fairest basis for assessing duties not only for ourselves but also for other countries. Some importers object to this, because it prevents sharp practices which are now in vogue under the foreign valuation.

As a basis for determining the amount of specific or ad valorem rate, it is necessary to obtain information regarding the costs in this country as compared with the costs in the foreign country. Therefore in considering whether or not a tariff is necessary on any particular line of product, an analysis of this product's costs is necessary, and in order to properly present the matter to the Ways and Means Committee and the Senate Finance Committee of Congress, it becomes necessary that each of the Nema sections desiring a tariff or change in the present tariff, study the labor and material contents of their products, also the rates of wages paid here and abroad, and if possible they should obtain the cost of production by foreign manufacturers. This is imperative in any case where an increase in rate is applied for under the so-called flexible provisions of the 1922 act.

If there have been imports into this country and definite figures can be given to show that those imports are seriously affecting the manufacturers in this country, this of course will strengthen your case. (Several groups in our industry have found foreign competition increasingly severe.) But in all cases facts have to be presented showing definitely the need of a tariff and the amount of protection the industry needs.

Those divisions of our industry, desiring to have consideration in the next revision of the tariff, must study the labor and material contents of their products, and also obtain data in regard to foreign competition if possible, and submit statements as to the average cost of labor in this country and abroad, if figures are available. Your tariff committee will then take these various studies, made by the different sections, and see if some of them can be consolidated and placed into certain paragraphs in the new tariff bill.

Some of the members of your tariff committee have been asked just what to include in the labor content:

All labor should be included in this, both direct and indirect, wages and salaries, labor usually charged to overhead, clerks and others.

Under material, all material.

Charges to be placed under overhead are such as taxes, insurance, depreciation, rent, interest on capital invested in plant and equipment, and all items which cannot be properly classed as labor or material.

As is indicated, it is necessary to study the rates of wages compared with the foreign rates of wages for similar positions. It is also necessary to study the productiveness of the individuals in both countries. There are instances in this country where we pay a high rate of wage, but by application of efficiency in management and labor-saving machinery, we are able to get a lower labor cost per unit than prevails in the foreign market, even though the foreign labor itself is paid a lower rate of wage. This is true in certain phases of the electrical manufacturing industry, while it is not true in other divisions.

You will see from the foregoing that each section or group of this association should make a careful study of the situation as it affects its products.

There is another phase of the tariff work which is not generally understood, namely, that under the Tariff Law of 1922 for the first time in the history of the tariff, the American manufacturer has the right to appeal in case he finds importations are affecting his business, and this protects him against unfair methods of competition and unfair acts in the importation of articles into the United States.

Unfortunately American manufacturers have not availed themselves of the privileges of this portion of the act, except in a few instances. There are certain divisions of the electrical industry which are now applying for appeal.

Many manufacturers do not realize that oftentimes an appraiser will assess a duty under a certain paragraph and the importer will appeal with a view of having the tariff reduced by having it included under another paragraph. The government is extremely desirous of supporting the appraiser and the Customs Courts are there for that purpose. However it is very difficult for the government's attorneys to argue the cases without having information from the American manufacturers to sustain the appraiser. Your committee believes that each section of our industry should be willing to furnish witnesses to the government to sustain the government's position where you believe it to be right.

REVISION of the existing tariff law will probably be undertaken by the next Congress. Many electrical manufacturers complain bitterly of the existing law, but unless they take an active part in changing it they may be equally disappointed in the expected revision. The existing situation and the reasons for doing something about it are clearly set forth in this statement by Mr. Allen, made before the meeting of the National Electrical Manufacturers Association at Briarcliff, N. Y., October 30.

THE EDITOR

As to the difficulties with which the electrical manufacturing industry is confronted under the present tariff law: Most of the importations in the electrical manufacturing business fall under the following paragraphs:

Paragraph 1441 — Electrical insulators of synthetic phenolic resins —30 per cent ad valorem.

Paragraph 368—Measuring mechanisms—45 per cent ad valorem.

Paragraph 216—Electrical carbons, electrodes, carbon brushes—45 per cent ad valorem.

Paragraph 226—Electric light bulbs and lamps—20 per cent ad valorem.

Paragraph 320—Storage batteries—40 per cent ad valorem.

Paragraph 339—Table, household and hospital utensils. This is a long paragraph with various specific and ad valorem duties on articles, depending upon their composition and use; but statement is made that any of the foregoing articles containing electrical heating elements as constituent parts thereof are subject to a 10 per cent ad valorem duty. Thus, this 10 per cent is added to the regular duty.

Paragraph 372—This paragraph is the one under which most of the electrical machinery comes. It is known as the "machinery paragraph." Under this steam engines are assessed at 15 per cent ad valorem; textile machines and parts, at 35 per cent ad valorem; and all other machines not otherwise specifically provided for and parts, 30 per cent ad valorem. It is this clause that has caused the most trouble in the tariff so far as our industry and many other industries are concerned.

Paragraph 399—This is what is known as the "metal catchall clause," and most of our electrical machinery was

(*Continued on page* 255)

American Standards Association Formed

W. J. Serrill, president of the United Gas Improvement Company of Philadelphia, heads new organization to succeed American Engineering Standards Committee

UNANIMOUS approval by the thirty-seven member bodies of the establishment of the American Standards Association to succeed the American Engineering Standards Committee, is announced by William J. Serrill, assistant general manager of the United Gas Improvement Company of Philadelphia. Mr. Serrill was chairman of the Standards Committee, and now becomes president of the American Standards Association. One of the most important results of the abandonment of the committee form of organization will, according to Mr. Serrill, be a much greater degree of participation by trade associations in the direction of the national industrial standardization movement.

Board to Control Activities

ONE of the first acts of the Association will be the organization of a board of directors composed of twelve industrial executives. This newly created board, which was established in recognition of the increasing part which executives are playing in the standardization movement, will control the general administration and policies of the Association. The old Main Committee, made up of representatives of all the member-bodies, now becomes the Standards Council, and in its hands will rest all matters connected with the adoption and approval of national standards.

The officers of the Association are, in addition to Mr. Serrill: Vice-president, Cloyd Chapman; secretary, P. G. Agnew; and assistant secretary, F. J. Schlink. The advisory committee of Industrial Executives includes: J. A. Farrell, president of the United States Steel Corporation, chairman; George B. Cortelyou, president of the Consolidated Gas Company; John W. Lieb, senior vice-president of the New York Edison Company; L. F. Loree, president of the Delaware & Hudson Company; and Gerard Swope, president of the General Electric Company.

The American Engineering Standards Committee was organized in 1917 by the American Society of Civil Engineers, the American Institute of Mining Engineers, the American Society of Mechanical Engineers, the American Institute of Electrical Engineers, and the American Society of Testing Materials. The purpose of the organization was to provide a method of cooperation which would prevent duplication in standardization work and the promulgation of conflicting standards. The United States Government Departments of War, Navy and Commerce became members of the committee in 1919. New members were from time to time added until at the time of the present reorganization there were 37 member-bodies. There are in addition 350 sustaining members, including manufacturers, distributors, associations, and others.

A broad range of industries and of types of standards are included in the work of the Association. The following types of standards are covered:

1. Nomenclature. Definitions of technical terms used in specifications and contracts and in other technical work.
2. Uniformity in dimensions necessary to secure interchangeability of parts and supplies, and the interworking of apparatus.
3. Quality specifications for materials and equipment.
4. Methods of test.
5. Ratings of machinery and apparatus which establish test limits under specified conditions as a basis of purchase specifications, or which establish requirements as to performance, durability, safety, etc., under operation.
6. The codifying of provisions for safety.
7. Rules for the operation of apparatus and machinery in industrial establishments.
8. Concentration upon the optimum number of types, sizes, and grades of manufactured products.

The method of work is simply a systematic plan of cooperation by which organizations interested in any particular project participate (1) In deciding whether the work small be undertaken at all, (2) in formulating the standard, and (3) in its ultimate approval as an "American Standard."

Procedure for Adopting Standards

THE decision as to whether work on a standard shall be undertaken is made by a general conference of representatives of all the groups concerned with the standard or by any equivalent method which assures a consensus of opinion. One of the most important results of the reorganization is the more flexible procedure for adopting standards now available. Four methods are provided:

1. By sectional committees, which are essentially joint committees made up of officially accredited representatives of all groups having an important interest. The sectional committees may work:
   a. Under the administrative support and direction of one or more of the bodies principally concerned—termed "sponsors."
   b. Autonomously, reporting directly to the American Standards Association.
2. The approval of existing standards when it may be shown that the standard represents a real consensus.
3. By the approval of "proprietary" standards when it may be shown that they are supported by a consensus of those substantially concerned.
4. By the official acceptance of the interested groups concerned.

The United States Government cooperates actively with the Association in several ways. In addition to the seven

branches of the federal government represented on the Standards Council, 38 branches are represented on sectional committees. Twenty-one Association projects are sponsored by various branches of the federal government, which are represented on almost every sectional committee working under Association procedure. The Department of Labor is cooperating in all safety code work and is publishing approved safety codes as government documents.

At the time of the organization of the American Engineering Standards Committee there were more than one hundred different organizations publishing engineering standards, most of which were formulated without systematic methods of cooperation or communication of information between the various organizations concerned. For this reason, the original five members of the former American Engineering Standards Committee organized for the formation of some method of cooperation to prevent duplication in standardization work and the promulgation of conflicting standards.

Shortly after the first meeting of these five original members a constitution was adopted and in 1919 this was broadened to permit the representation of other national bodies. Later, the rules of procedure were completely revised as a result of the work of the committee in the development of the new work of unifying engineering and industrial standards along national lines. The most important of these latter changes were in the making of the procedure still more flexible and in introducing the representational basis in the organization of sectional committees, that is, providing that they be made up of representation accredited for the purpose of the industry or organizations concerned. Since that time until the recent formation of the American Standards Association there have been no important changes in the organization or procedure, the recent development being one necessary by rapid and continuous growth.

The important role that standardization plays in industrial progress, and its economic and social potentialities are rapidly becoming more generally understood. It is well known that standardization simplifies manufacturing processes; it stabilizes production and employment, since it is safe for the manufacturer to accumulate stock during periods of slack orders, which he could not well do with an unstandardized product. Standardization also broadens markets; it lowers cost to the consumer by making mass production possible; it enables buyer and seller to speak the same language and makes it possible to compel competitive sellers to do likewise. Morever, standardization reduces selling costs; it stimulates research and makes for the elimination of antiquated methods as well as products.

Among those who are directly interested in the American Standards Association are such well known engineers as Cloyd M. Chapman. Born in 1874 and receiving his education at Cornell University Mr. Chapman first entered the business world in research work in the laboratories of Thomas A. Edison. Later he took up field investigation work and in 1904-1905 toured the world in this work. After this he became associated with the well-known engineers, Westinghouse-Church-Kerr & Company of New York, as an engineer in charge of design, construction and research, having to do with the planning and construction of many large power stations and other similar developments. Mr. Chapman is a member of the American Society of Mechanical Engineers, the American Chemical Society, the American Society for Testing Materials, the American Concrete Institute and the former American Engineering Standards Committee.

Another member of the Association is P. G. Agnew. He was born in 1881, and received his education at the University of Michigan and Johns Hopkins University. Later he became a physicist on the scientific staff of the United States Bureau of Standards. He is a writer of note on research, physics and electrical engineering and is a member of the American Institute of Electrical Engineers, the American Physical Society and the Washington Academy of Science.

Other members of the Association, Gerard Swope, J. W. Lieb, L. F. Loree and F. J. Schlink are probably too well known in the business world to need further mention.

There are now national standardizing bodies similar to the American Standards Association in 19 foreign countries. The Association is constantly in touch with these, and all standards are exchanged. National standards developed abroad are thus made available in this country for the use of exporters, manufacturers and others.

Up to the time of its reorganization into the American Standards Association 285 projects were given official status, as follows:

Civil Engineering and Building Trades	35
Mechanical	77
Electrical	53
Automotive	5
Transportation	10
Naval Architecture and Marine Engineering	1
Ferrous Metallurgy	4
Non-Ferrous Metallurgy	10
Chemical	8
Textile	2
Mining	19
Wood	5
Pulp and Paper	2
Petroleum	19
Miscellaneous	35
	285

Member Bodies of the American Standards Association

American Electric Railway Association
American Gas Association
American Gear Manufacturers Association
American Institute of Architects
American Institute of Electrical Engineers
American Institute of Mining and Metallurgical Engineers
American Mining Congress
American Railway Association—Engineering Division
American Society of Civil Engineers
American Society of Mechanical Engineers
American Society for Testing Materials
Association of American Steel Manufacturers
Cast Iron Pipe Research Association
Electric Light and Power Group:
- Association of Edison Illuminating Companies
- National Electric Light Association

Fire Protection Group:
- Associated Factory Mutual Fire Insurance Companies
- National Board of Fire Underwriters
- National Fire Protection Association
- Underwriters' Laboratories

Gas Group:
- Compressed Gas Manufacturers Association
- International Acetylene Association

National Association of Machine Tool Builders
National Automatic Sprinkler Association
National Electrical Manufacturers Association
The Panama Canal
Portland Cement Association
Safety Group:
- National Bureau of Casualty and Surety Underwriters
- National Safety Council

Society of Automotive Engineers
Telephone Group:
- Bell Telephone System
- United States Independent Telephone Association

U. S. Department of Agriculture
U. S. Department of Commerce
U. S. Department of the Interior
U. S. Department of Labor
U. S. Navy Department
U. S. War Department

ELECTRICAL EXPOSITION Has Record Attendance

Twenty-first annual exposition exceeds in point of attendance, number and diversity of exhibits and public interest manifested in home appliances

WITH a record attendance and the largest number of exhibitors in its history, together with the most extensive and diversified display of electrical apparatus and devices ever shown on such an occasion the New York Electrical and Industrial Exposition was opened to the public in Grand Central Palace, New York City, October 20, continuing until October 27. From October 17 to 20 the exposition was known as the National Electric Trade Show, to which manufacturers, distributors and dealers only were admitted. While this was the twenty-first annual electrical exposition it was the first time that the National Electrical Trade Show had been held, and inasmuch as it proved so popular it is thought that it will be repeated at subsequent expositions. Primarily it gave those interested an opportunity to visit the different exhibits and become familiar with products other than their own, which, to say the least, was very educational indeed.

This year more than 150 manufacturers, distributors and dealers had their products on display and among them were upwards of forty different kinds and types of electrical appliances, as well as many strictly electrically operated mechanical devices.

While there were not as many outstanding developments this year as there were at former expositions there was a strikingly noticeable improvement in the refinement of appointments and in the increased efficiency and simplicity of operation of many of the appliances. This was particularly true with respect to compact construction, catchy color schemes, attractive cabinets and other features tending to improve the appearance of the devices.

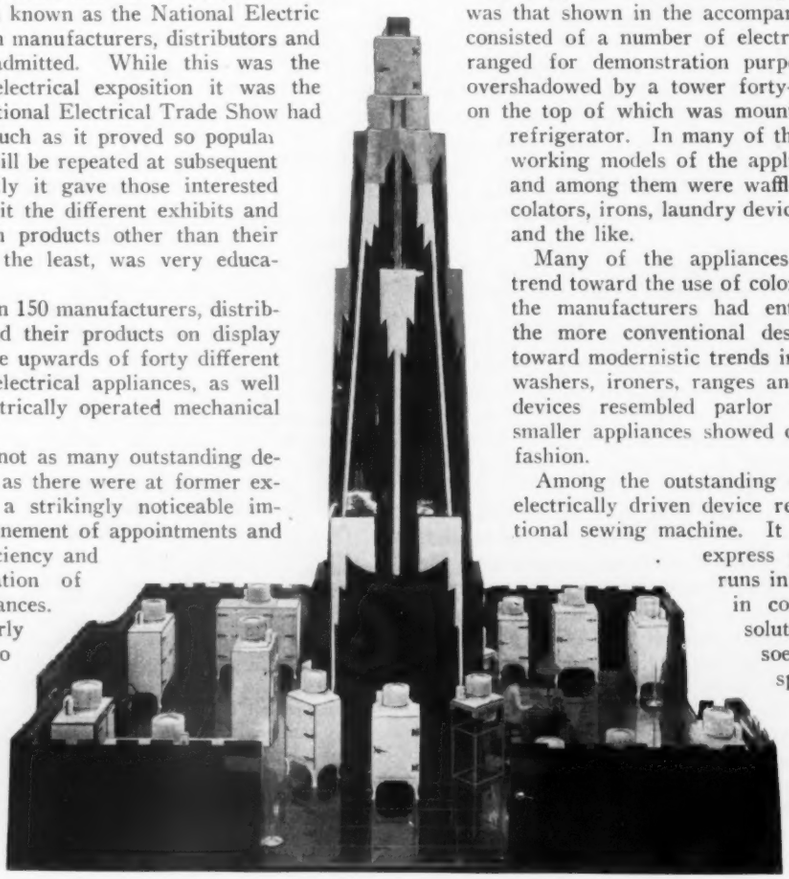
The exposition was open to the public for six days, from 11 a. m. until 11 p. m., and each day it was attended by approximately 15,000 visitors. And, so well were many of the displays arranged and so attractive was much of the apparatus that it would be difficult to determine in just what part of the exposition the visitors were most interested. Thousands of women gathered around the different booths daily to inspect and learn about electrical appliances, and as has been the case in recent years much interest was manifested in electrical refrigeration, while the smaller appliances, laundry equipment, ranges, heaters, cleaners, electro-therapy apparatus and floor machines received their full share of attention.

Probably the most novel display at the exposition was that shown in the accompanying illustration. It consisted of a number of electrical refrigerators arranged for demonstration purposes and these were overshadowed by a tower forty-three feet in height, on the top of which was mounted a standard model refrigerator. In many of the other booths actual working models of the appliances were exhibited and among them were waffle irons, toasters, percolators, irons, laundry devices, kitchen appliances and the like.

Many of the appliances showed clearly the trend toward the use of color and in some of them the manufacturers had entirely departed from the more conventional designs with a leaning toward modernistic trends in art. In this respect washers, ironers, ranges and some of the larger devices resembled parlor furniture, while the smaller appliances showed clearly the dictates of fashion.

Among the outstanding exhibits was a small electrically driven device resembling the conventional sewing machine. It was designed for the express purpose of repairing runs in silk stockings. Novel in construction, using absolutely no thread whatsoever, and running at a speed of 3000 revolutions a minute this tiny machine mended the runs in stockings so well and so rapidly that it was almost impossible to determine that they had been damaged.

Television also came in for its full share of attention as at one of the booths equipment was installed to permit of televising the visitors for the benefit of their friends and others in the audience. Likewise, moving picture apparatus for the home was on display, pictures were shown and the equipment was explained, with respect to the use of projectors.



ONE of the novel exhibits at the twenty-first annual Electrical and Industrial Exposition, held in Grand Central Palace, New York City, October 17 to 27, is illustrated above. Notice the refrigerator on the forty-three foot tower.

STYLE SELLS ELECTRICAL GOODS

An electrical manufacturer who does not appreciate that his business is permanently influenced by style is going to be seriously handicapped

By John Allen Murphy
Marketing Counsellor

AN article appeared in the September issue of Electrical Manufacturing on the effect of the color vogue on the merchandising of electrical appliances. The consensus of that article was that while color is now very much in the saddle, it is only a passing fad and that it will have no permanent influence on the selling of electrical goods.

I am heartily in accord with the conclusions of that article. Color is only one period in a style cycle. Since a cycle keeps steadily revolving, the color period will eventually be superseded by the next period. Fashion is a great show-woman. She never permits us to grow tired of her presentations. Just as soon as we are beginning to weary of her latest offering, she shifts the scene and gives us something radically different to hold our attentions. Fashion, taking her cue from nature, makes change the first law of her being.

Since color has been occupying the Fashion stage for several years, it is undoubtedly already looking for its exit. A period in a style cycle never lasts long. It depends on the product, the good taste and utility of the style, and a number of other factors. A particular vogue may last only a few months, as in the case of a cravat, or up to forty or fifty years, as in the case of a personal habit, such as the clean-shaven face.

Products Must Be Fashionable

SO the electrical manufacturer should not delude himself by assuming that when the color fad passes he will be able to chuck the style nuisance out of his business. He will have no such luck. He can bet his last dollar on the fact that from now on the electrical business is going to be subject to the whims of Fashion, just as wearing apparel, furniture, architecture, toys, foods, sports, education and entertainment have been growing increasingly subject to it for many years. Though color will disappear, it will be immediately followed by some other vogue. That new vogue will prance in the limelight for a few years, and then it, too, will give way to the next offering in the style cycle.

An electrical manufacturer who does not appreciate that his business is permanently under the influence of Dame Fashion is going to find himself seriously handicapped. He won't be able to compete with those manufacturers who keep their lines up-to-the-minute and whose products contain all those style wrinkles that are so dear to present-day buyers. Unless the identity of his product is lost in some other product, he will have to give it a style appeal in addition to its basic utilitarian reason for existence.

Because a manufacturer makes a utility that is used to toast bread, clean a carpet, light a room, wash clothes, brew coffee, reproduce sound, or do any one of the 1,001 things that electrical devices are supposed to do, does not exempt him from making his product fashionable. People are no longer satisfied with mere utilities. They also insist on their utilities being in the current vogue.

There is really nothing new or startling about this. We have been hearing a lot about evolution in recent years—that man is "evoluting" from a lower creature to a higher being. Whether or not we accept the doctrine of evolution as applied to man, we must accept it with respect to man's handiwork. The evidence of it is before our eyes.

Fashion Evolution Is Moving Rapidly

IN the short span of our own lives, we have witnessed tremendous changes in clothing, food, furnishings, architecture, cooking utensils, means of travel, methods of living, etc. Examine any period in history and it will be observed that a steady evolution was going on in the size, shape and construction of the arts and crafts that were made during that space of time. Get a running picture of the clothing that men and women have worn since the earliest times and note how its style steadily "evoluted."

Look at the cooking utensils that have been dug out of the lost cities of the Ancients, and then trace the design of cooking equipment down to the present day, and it will be seen that the human race has never been content to leave well enough alone. It has always been reaching out for improvement, or at least for change, and getting what it wanted at fairly regular intervals.

It is true that evolution did not proceed as rapidly in days gone by as it is today. In the Middle Ages, a hundred years brought only slight changes in clothes, furniture, eating habits or living conditions. Today, radical changes transpire in a few months.

It is easy to explain the present rapid pace of style evolution. The three economic necessities of mankind are food, shelter and clothing. Primitive man was content with any food, shelter and clothing he could get. He could

even dispense with the shelter and clothing sides of this economic triangle if he found it necessary. As civilization progressed, man demanded greater refinements in his food, shelter and clothing. He wanted more clothing, a greater variety of food and a dwelling that was better than the cave or hut that satisfied his ancestors.

However, while man's desires augmented with the passing of the centuries, it was not until recent years that he has been able to gratify any large proportion of these desires. The people of an older day did not have the obsolescence problem. They were not annoyed with a constant influx of new models. They didn't have to worry about trade-ins. They lived in their houses until they fell down. Furniture was passed from one generation to another. Men sewed their clothes on for the winter and got new garments only when the old ones would no longer hold together. It is true that Fashion evolution was going on all this while, but it moved so slowly that no radical changes took place in a single generation.

Grace and Beauty Are Demanded

NOW, society has so greatly improved its economic well-being that people can afford to gratify any desire or fancy or ambition that may possess them. They not only want food, shelter and clothing, as of old, but they want grace, novelty, beauty, variety, convenience and even luxury in their food, shelter and clothing.

Luther Burbank in his book, "The Harvest of the Years," tells how plants first fight for existence and after they achieve that they begin to develop aesthetic qualities. Let me quote him briefly: "The most fixed and inflexible characteristic of a tree is to fight for existence and to recreate itself; later it learned to vary; later it learned to grow a fine protective spread of foliage to protect itself; later, perhaps, it learned to give its fruit a certain amount of sugar over and above the amount needed to protect its stone, or pit, properly; later, we'll say, it learned to color its fruit, and so on.

"It came to the place, in the end, where the plant had developed what I can almost call an artistic temperament—a response to demands for beauty and flavor and odor, and so on. Most fruits, even in their wild state, have some beauty or flavor or aroma in blossoms or fruit—partly put there to attract bees and birds to help in pollenization or the dissemination of seeds, but also partly, I think, in answer to the universal urge of beauty in our universe."

People follow the same course as plants. They fought for a bare existence for ages. And now, that at last they have achieved economic independence, they are gratifying the aesthetic side of their natures. Manufacturers are trying to sell against a whirlwind if they fail to put aesthetic qualities in their goods.

Novelty or Newness Is Necessary

MIXED up with the desire for the beautiful product is the equally strong desire that it may have novelty or newness or some improved feature. If a woman wanted to buy a new vacuum cleaner, and found it exactly like her old one, she would be terribly disappointed, and would undoubtedly chide the industry for its lack of enterprise. If our toaster broke down beyond the possibility of repair, the chances are we would buy a new one immediately, but it is most likely that we would search the shops until we found one that was somewhat different from the toaster that we had been using. It has been demonstrated repeatedly in every line of business that it is impossible to get many people to keep buying a succession of a standardized product. No matter how satisfied they were with their last purchase, they will seek something different the next time they buy.

No manufacturer is big enough to buck this trait in human nature. The greatest manufacturing genius the world has ever produced—Henry Ford—thought he could win out against Fashion, but his genius was no match for her wiles. Model T was able to bounce over the roads in 1927 just as well as when it was first designed a dozen or fifteen years earlier. From the utilitarian standpoint, Model T was still a marvelous value for the money. Nevertheless, the public began turning their thumbs down on it. Why? Not because it wasn't a good car, but because it was out of fashion. Though the Ford was able to give the dust to many a more expensive car, still people were apologizing for owning a Ford or even for riding in one. No manufacturer can long sell his product to a public that is ashamed to own it.

So Ford very wisely decided to change his model. He saw that a car had no value in the public eye unless it had style value on top of its utilitarian worth.

At one time, the Dodge was the second largest selling car in America. In recent years it has slipped somewhat from its once eminent position. The company made the mistake of over-staying on its models. Dodge fans wanted something new and were disappointed when the company failed to give it to them. However, Dodge sales have been coming back nicely since the organization brought its models in tune with the dictates of Fashion.

The Cadillac is another car that was penalized because it was too conservative. But when the company introduced its famous five-hundred-color plan, the Cadillac became the flapper instead of the grandmother of the motor world.

Fashion and the Automobile Business

SO urgent is the demand for change in the automobile business that the manufacturers are now even changing the names of their cars at occasional intervals. The Hupmobile Company called its cars Hupmobiles, no matter what their model. Now it features the Century Car and sidetracks the name Hupmobile. What was once a Reo is now known as a Flying Cloud. The Franklin is called an Airman more than it is by its old name.

Fashion is exerting an unbelievable influence on the automobile business. It is now figured that a new car loses sixty-two per cent of its salable value the minute it is purchased by its first owner. In other words, sixty-two per cent of the desirability of an automobile is its Fashion appeal. If the original owner of a car tried to sell his purchase twenty-four hours after he acquired it, he would have to sell it as a second-hand automobile. A second-hand automobile has little or no style value. On the other hand, if the new car remained in the hands of the first owner, it would retain its Fashion value for a couple of years.

The resale value of a new car is declining about three per cent a year. Five years ago it was reckoned by automobile men that a car lost only forty-six per cent of its value when it was bought by its first owner. By 1925 this figure had jumped to fifty-five per cent, and now it is sixty-two per cent.

If the public does not insist on frequent style changes in a product, manufacturers often make these changes anyway, as a means of rendering the old product obsolete and thus forcing the public to buy the latest models. Take men's hats as an example. While a hat is not an electrical product, it furnishes us with such a striking example of what Fashion changes will do to boost the sale of an article that I am sure electrical manufacturers will benefit from the illustration.

Three Stages of Product Development

MEN are inclined to be careless about their hats. On the average, men in the United States buy only two felt hats in three years. The manufacturers feel they should buy two a year. So, this year, the manufacturers decided to make hats so different that old headgear would be outlawed and men would be ashamed to wear it. According to the Textile Division of the Department of Commerce, the brim of this season's hat is very narrow. For several seasons hat brims have predominated at two and one-half to two and

five-eighths inches. This year they are running from one and seven-eighths to two and one-fourth inches. The change is so obvious that an old hat can be spotted at once. It is said the strategy is driving men into hat shops in unaccustomed numbers.

In considering the influence of Fashion on an electrical article, it is well to remember that nearly every product goes through three stages. In the first stage, the only thought of the manufacturer or inventor is to make the product work. When Edison invented the electric lamp, he didn't care anything about the looks of his first lamp. He was satisfied if it gave light. It did not have to possess a Fashion appeal.

In the second stage, it is the job of the manufacturer to perfect the new product—to make it work better. In this stage some attention is given to improving the appearance of the device, but the primary concern of the producer is to make a better article. The electric lamp remained in this second stage for about thirty years.

During the third stage, the manufacturer of a new product continues to improve it where possible. In addition, however, as soon as he reaches this stage, he begins to give his product artistic qualities. He improves his designs, thinks more about beauty and gives Fashion an important place in his sales plan.

Radio passed through the first two stages and has reached the third stage within ten years. The first crystal sets were terribly crude. Most of them were put together at home. The amateur was delighted if he succeeded in getting them to reproduce any sort of sound.

Fashion Is Not Wasteful

BUT improvements in these first crude sets came tumbling so fast that it was impossible to keep up with them. The enthusiast who was so pleased with his crystal set, soon wanted a one-tube machine. Then his desires mounted to a two-tube outfit, and kept on going up until they reached the electrically-operated eight or nine-tube set.

During this period of rapid mechanical improvement, it was not necessary for the radio manufacturer to use his Fashion appeal in his business. His market expanded fast enough on the strength of the drastic technical changes he was introducing every few weeks. But now that radio has reached the third stage of its development, the manufacturers must be careful to keep their product in tune with Fashion. They are now making furniture as well as a mechanical product, and henceforth they must do what all furniture manufacturers have found necessary—keep in motion a constant evolution in design.

Some people are disposed to decry the waste that follows in the wake of Fashion. Discarding a perfectly good product simply because it is out-of-date, is regarded as the height of wastefulness. But there is no cause for worry. It should be emphasized that only the ten or fifteen per cent of our population that are in the well-to-do strata is keeping up with Fashion. It is they who buy new automobiles, use them for two or three years, and then trade them in, simply because they have lost their style qualities.

Fashion Develops Second Hand Markets

I AM referring to the automobile so much in this article not only because it is the most outstanding Fashion product, but because the automobile must be regarded essentially as an electrical product. Be that as it may, the automobile is the best sold product in the world today, and every manufacturer, no matter what line he is in, can learn selling lessons from a study of automobile methods.

The average automobile now has a life of eight years. During this period it will have from two to five owners, and in some instances even more. The last owner of the car may have paid no more than fifty dollars for it. When the first owner traded-in the car, it passed into the hands of a man who could not have afforded to own a new automobile of that make. In other words, because the first owner was fussy about style, gave the second owner an opportunity to own a good car at a price he could afford to pay.

When the second owner disposes of the car two or three years later, it passes to a new owner who is in a still lower strata of society and who would have to remain carless were it not for the opportunity the third-hand market placed in his reach. The last downward step of the car to the fourth, fifth or sixth owner, placed the ownership of an automobile within the reach of anyone with fifty or seventy-five dollars. Here we have an explanation of why such a large percentage of the public in this country owns automobiles. Fashion makes it possible.

The same thing is happening in radio and other luxury products. Only in radio, it has been the custom of the original owner of a set to give it to a friend or relative when he buys a new one. From now on, though, we may expect to see a second-hand market of considerable size in the radio business. This will place the ownership of a radio within the reach of every person, no matter how humble his circumstances.

Constant Design Improvement Is Required

A SENSATIONAL instance of what constant improvement in the product and evolution in design will do for a business is found in the experience of the W. A. Sheaffer Pen Co. The rapid rise of this concern has been phenomenal. I mention it here only because this company has made the fountain pen an electrical product. Mr. Sheaffer introduced one innovation after another with such speed that it kept the fountain pen industry dizzy trying to keep up with him. Finally, Mr. Sheaffer brought out the desk set. At one blow this introduction more than doubled the fountain pen market. The desk set was gradually improved until a model was evolved which makes a desk lamp an integral part of a pen set. Incidentally, the unit of sale in this business was raised from a former maximum of $7.50 to a present maximum of approximately $100.

Every manufacturer of an electrical product must regard constant design improvement as a paramount obligation to his market. If he does not keep his appliance moving along with Fashion, he may be sure that his market will eventually desert him.

Keeping in Style Is Not Difficult

HOWEVER, keeping a product in style is not so difficult. All the manufacturer has to do is to work with the various forces that are so freely offered to help him. Most of the concerns that are selling an industrial product or material furnish an engineering service to their customers. By taking advantage of this expert service, there is no danger of an electrical manufacturer falling behind on his designs or on the fashion aspects of his product.

Merely by watching alertly all of the materials that are being offered for his use, a manufacturer would come pretty close to keeping the articles he makes in the swim. For example, it is very likely that chromium plating will succeed color as the next vogue in the household appliance business. In fact, that day is already here. Chromium is already being extensively used in plating electrical appliances as well as numerous other things.

Several silver manufacturers who have always been confining their line to solid and plated silverware, have been obliged to add chromium-plated ware to their family. Pewter also is in again. It, too, has been added to several silverware lines.

This shows how impossible it will be for any manufacturer in the future to confine his line to a single material, a single idea, or to any one-track proposition. He must give his customers what they want, and what they want is likely to be what Fashion dictates.

Value of Electric Heat Is in Accurate Control

Electricity furnishes economical heat for such work as annealing and heat-treating steel, annealing copper and brass, and melting tin and babbitt

ELECTRIC operation of ovens, furnaces, and other types of heating equipment has come into general use in a number of industries during recent years. The characteristics of electric heating are well known and the results obtained have led to its substitution for other methods in many fields of manufacture.

Some of the typical installations and processes of the General Electric Company are illustrated and briefly discussed on pages 226 and 227. Although this series of illustrations is confined to applications in the electrical industry, it should be remembered that many other industries find it advantageous to use electric heat. The baking industry is adopting electric heat for the huge conveyor-type ovens for baking bread; the glass industry for annealing bottles, plate glass, and special ware; the newspaper industry for melting type metal for line-casting machines and for stereotype casting.

Electric furnaces contribute, in large part, to the success attained in the economical manufacture of many high-grade products. Heat-treating, for example, is one of the most exacting processes in the manufacture of machinery parts, as the life and service of many products depend largely on the quality of the heat treatment. With electric furnaces, results can be duplicated accurately, day after day. Electric heat provides reliable and uniform temperatures and thus simplifies technical processes.

Advantages of electric heat can best be suggested by describing a few of its applications and showing how flexible control not only assures a high grade product but saves money.

Furnaces for Baking Carbon Brushes

IN the manufacture of carbon brushes, the carbon, in powder form, is mixed with suitable liquid binders and pressed into shape in molding machines. The blocks then require careful baking to develop the binder and to give the brushes the desired characteristics. In the baking operation, the temperature must be raised slowly, and preferably at a definite rate, requiring several days to reach the baking temperature.

The control for furnaces used for this purpose is provided with time-rate instruments, which raise the temperature automatically at the prescribed rate and hold it at baking temperature. The use of such apparatus will, in many cases, permit heating cycles to be shortened because of the accuracy of control. This increases the capacity of the equipment and reduces the cost of treatment.

Vitreous-enameling Furnaces

THROUGHOUT the manufacture of such products as the linings, legs and other parts of electric refrigerators, the furnace doors, as well as the movement of forks and carriage for handling the material, are operated from a central control position by only one man. The temperature is automatically controlled. Electric furnaces are particularly well suited to vitreous-enameling. The atmosphere is clean; the temperature distribution is uniform; the response or "come back" is quick from charge to charge, permitting a high output, and yielding a product of exceptional uniformity. Two temperature controls, one at the front and another at the back, equalize the temperature.

Several electric furnaces are in use at General Electric for firing vitreous-enameled coating on reflectors for incandescent lamps and for mercury-vapor lamps, as well as for miscellaneous parts that require such a finish. Because of the low heat losses from these furnaces, the enameling room is at a temperature comfortable to work in, and automatic control insures uniformly burned ware.

Copper-brazing Furnaces

MANY electric furnaces are now being used for copper-brazing together of steel parts used in the manufacture of turbines, electric refrigerators, and other apparatus. The work must be heated and cooled in an atmosphere of protective gas, in order to prevent oxidation. The furnace consists of cylindrical heating and cooling chambers—both of which may be raised—and a turntable containing three platforms, one of which may be unloaded and loaded while the others are heating and cooling. The cooling chamber also has an atmosphere of protective gas.

Electric furnaces are essential to this process as they can be constructed to exclude air, which would be exceedingly difficult with a fuel-fired furnace, because of the high temperatures required. Furnaces of the type just described can be used for bright annealing of sheets and other metal parts, to eliminate the cost of handling, pickling, and other operations incident to the manufacture of materials which require a bright surface. The use of protective gases in furnaces is relatively new, and has promise of a wide application in the future. These operations would be impracticable in a fuel-fired furnace, as the atmosphere could not be controlled.

Bright-annealing Furnaces for Copper Wire

COPPER wire used for making insulated wire and cable, enameled wire, and armature and field coils for motors must be annealed between successive drawing operations. Because copper will oxidize or scale readily at the temperatures necessary for annealing, it is necessary to exclude air from the furnace chamber. This is accomplished by building an inverted furnace chamber over a pit containing water, with the opening to the chamber below the water.

Such furnaces have a capacity of from six to ten thousand pounds of charge for every two hours. Only one man is required to operate such a furnace. Its economy in labor and floor space make the cost of annealing less than half the cost with methods formerly used. Approximately 25 pounds of copper are annealed per kilowatt-hour.

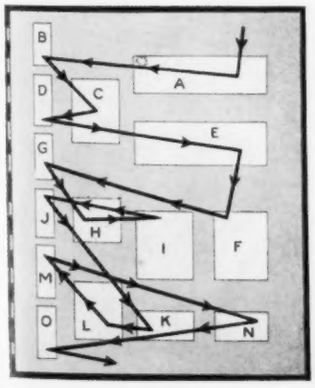
GOOD LIGHTING Builds *Profits*

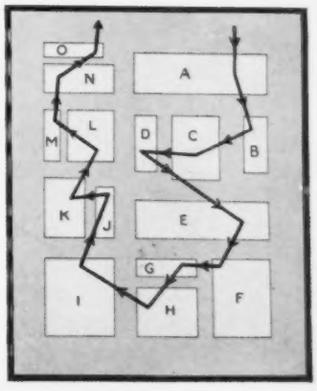
Changed to

helped one storage battery manufacturer to materially increase production, lower costs and minimize accidents

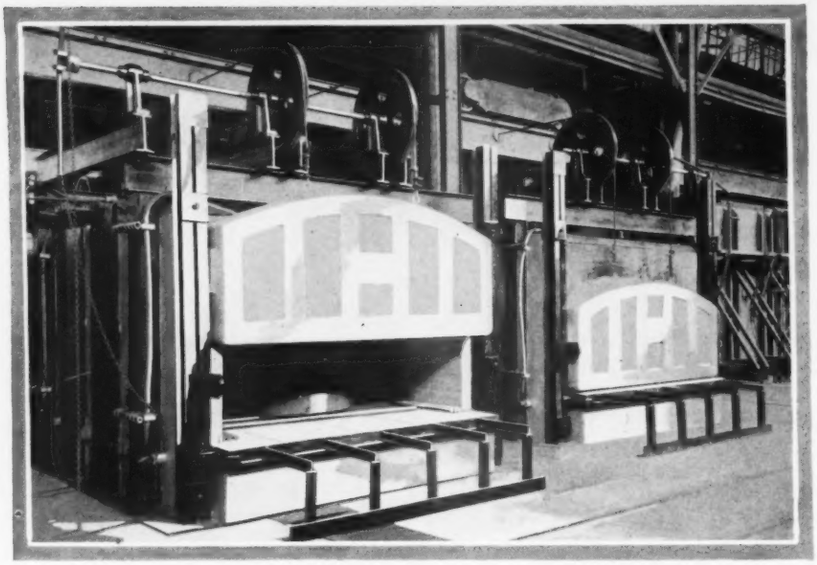
COSTS climb and production lags where workmen must go to the windows to see the fine details of their work. Men linger there, stare longingly out-of-doors or gossip with their friends while machines and benches are deserted and work piles up unheeded. A productive lighting system gives the same useful light at the machine or work bench as at the windows. In the far interior of departments light on the work is soft, clear and uniform. There is no need to go to the windows.

DARK sections of departments commonly used for material storage are converted into useful spaces suitable for production if they are properly lighted. Greater output without expansion is then made possible with but little cost. Straight line production flow is more easily accomplished with the aid of modern industrial lighting. That this is true may be seen from the two illustrations at the bottom of this page which show what was done in one shop with good light.





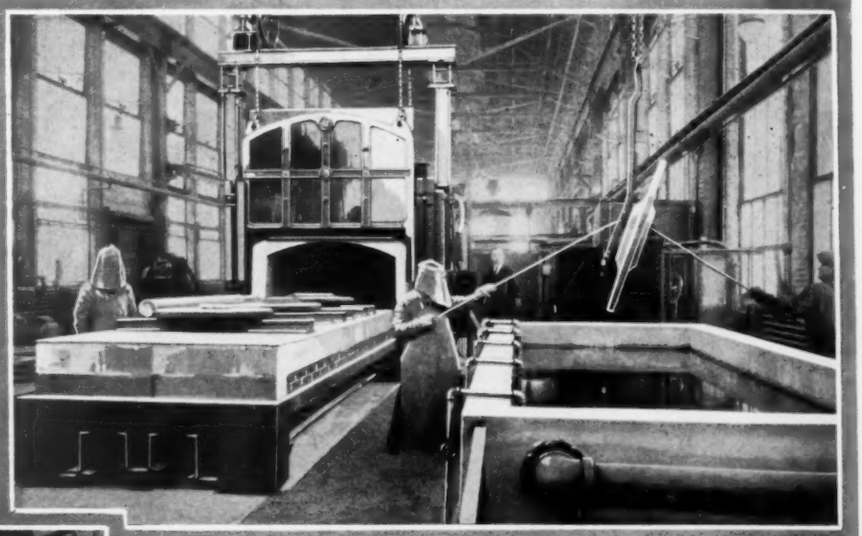
THE factory layout at the left shows the tangled flow of production under the restrictions of an old, inadequate lighting system. Placing operations B, D, G, J, M and O next to the windows for better light increased the materials handling between operations. Notice the revised layout of the same plant at the right, in which the simplified production movement is made possible by the installation of a modern industrial lighting system

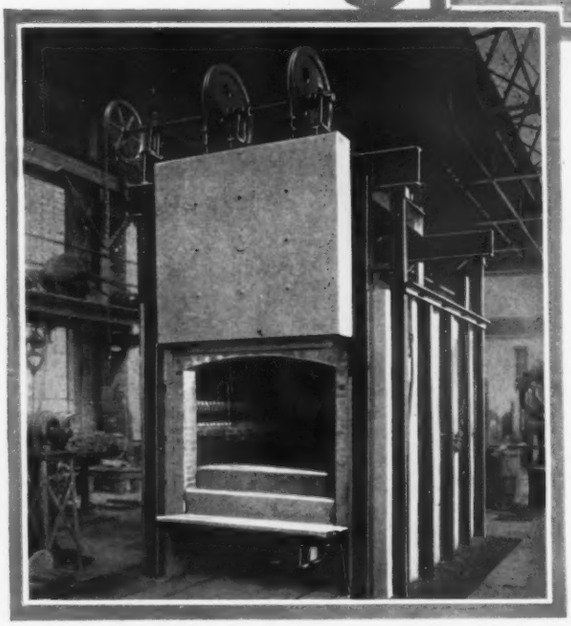


"Electric in Every

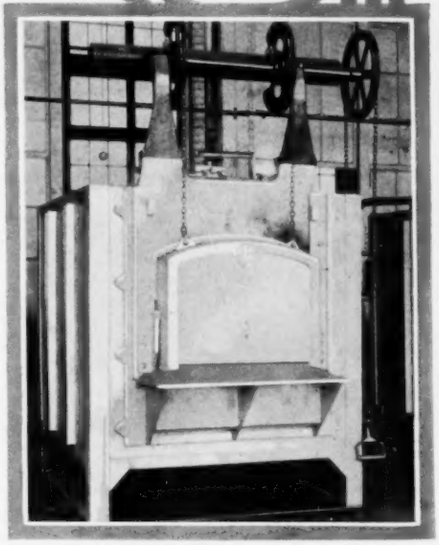
Such is the belief of General serving the tremendous ad electric heating in their own installations of electric heat connected capacity, and is over 80,000,000 *kw-hr. electric heat pointed out in are uniformity of tempera tion and from fire, and*

BOX type furnaces (above) with automatic temperature control are used in heat treating rotating parts of high-speed turbine generators. It is significant that these rings never require retreatment. To the right is shown a car-type hardening and drawing furnace used in heat treating bucket wheels and shafts. Carefully kept records have shown that the cost of heat treating per ton in these furnaces is about the same as in an oil-fired furnace, but that the product treated in the electric furnace is superior to that treated in the oil furnace



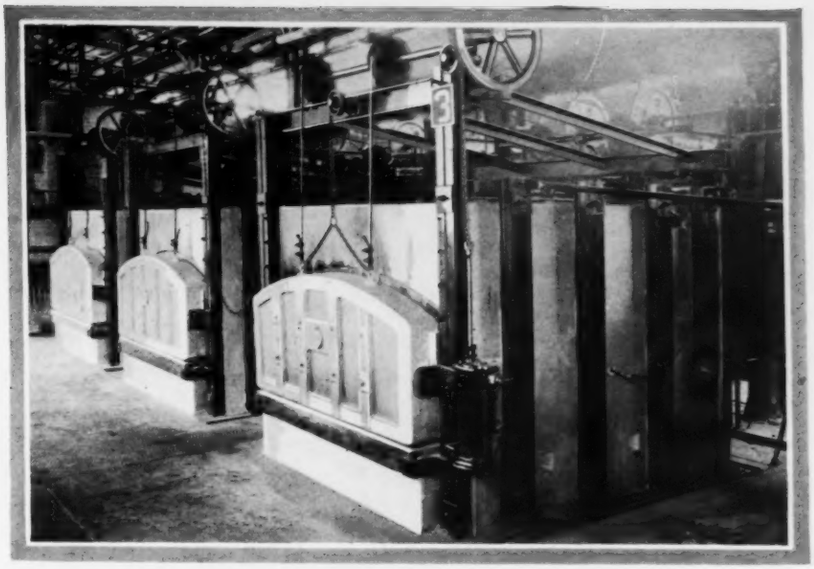


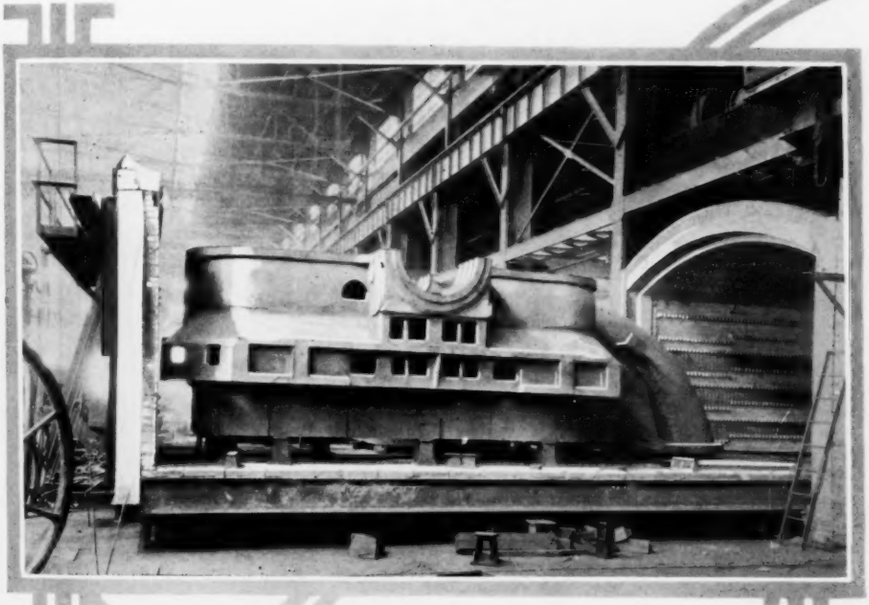
AT the left is shown a car-type furnace for annealing bars of high-speed steel for lathe and planer tools and cutters. Steels for this purpose are annealed four times. At the right is shown a box type furnace for annealing ceramic insulators. The furnace is used for cooling the material slowly from the hot but solid state



Furnaces
Industry"

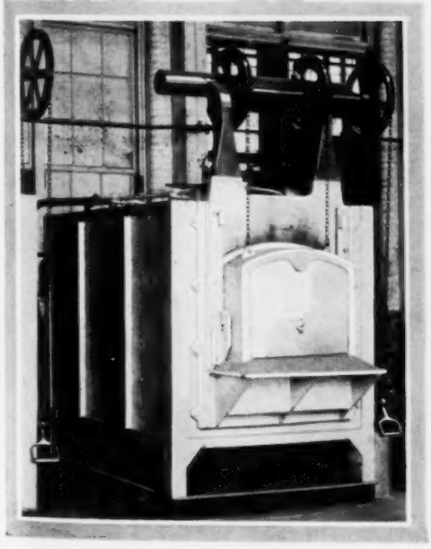
Electric Company, after ob-
vantages and savings of
factories. General Electric's
ing total over 40,000 kw.
their annual consumption
Among the advantages of
a new company publication
ture, safety both in opera-
better working conditions





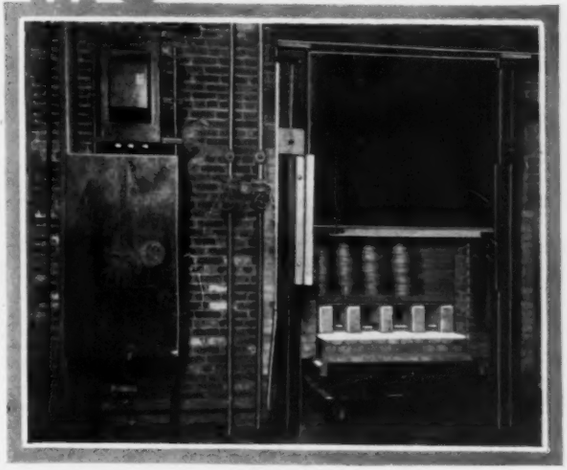
AT the left is a car-type furnace used for annealing large iron castings for turbines and other machines. This furnace is 28 ft. long, 16 ft. wide, and 9 ft. high, and accommodates castings weighing from fifty to seventy-five tons. Wide distribution of low temperature heating units permits the temperature to be raised slowly and uniformly. Castings requiring ageing, such as engine casting, milling machine and planer castings, and cylinder blocks for automobile engines are annealed in this type of furnace.

A bank of box-type hardening and drawing furnaces is shown above. These are used for heat-treating bar stock from which turbine buckets are machined. The different temperatures for hardening several grades of material are readily obtained and controlled by electricity



AT the left is a twin furnace to the one shown on the page opposite.

A small, car-type furnace for annealing steel blanks is shown at the right. The thickness of these blanks ranges up to 7 in. Two days' production is loaded on the car and is heated during the night without attendance



RIBOHM

Bar-Type Ribohm is the trade name of a patented resistive element made only by Ward Leonard Electric Co. It is a special alloy metal, formed into a "U" shape for structural strength.

The resistive element has a practically zero temperature coefficient of resistivity, does not suffer from "fatigue under vibration, and has a uniform cross section with resultant uniform temperature rise over the entire resistive element. Bar-Type Ribohm is continuous from terminal to terminal. Contact resistance is eliminated.

The method of support and cross section of bends prevents stresses in both the resistive element and support.

Weight for weight, Bar-Type Ribohm dissipates more energy than any other resistor. It is, light, rigid, strong, and simple in construction and in use.

7 Years' Field Tests Back RIBOHM

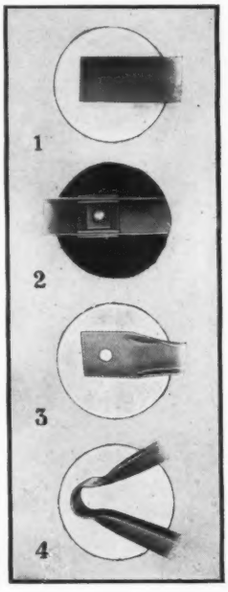
RIBOHM was developed in 1921 by the Ward Leonard Electric Co. to take the place of bulky or heavy, or fragile resistors then commonly employed for heavy duty work.

Laboratory tests progessively increased the fields in which Ribohm could be employed profitably.

Each new field was investigated in the laboratory. Ribohm was then placed in actual service in this new field.

Today, Ward Leonard offers Ribohm for electrical control equipment employing heavy duty resistors, with the assurance that its advantages and limitations are known definitely from more than seven years of tests in every major field of application.

Ribohm offers these advantages. It is economical to use, often reducing the weight of the entire resistor assembly from 50% to 75%. As it is mounted directly on the panel or base, frequently all internal wiring is eliminated. The little mass of Ribohm element and its non-stressing shape, makes it particularly useful in applications where excessive vibration is found.



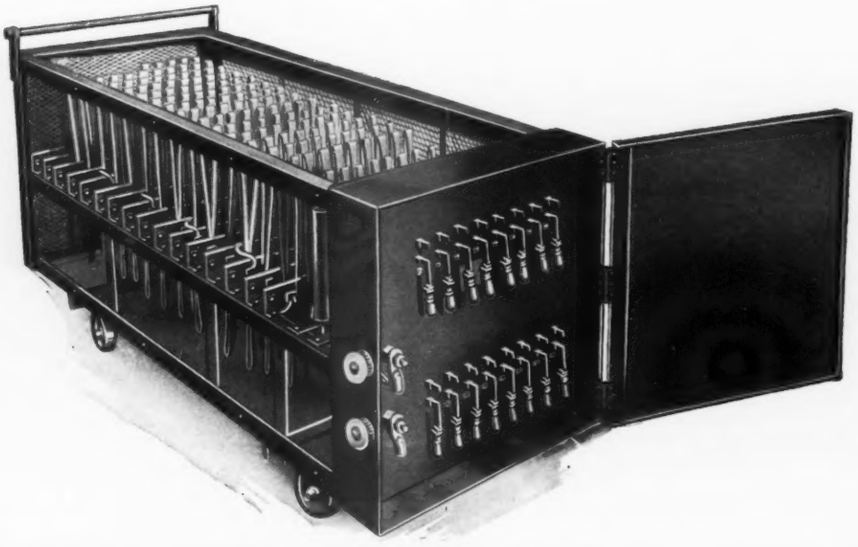
And—Ribohm has the highest energy dissipation volume of *any* resistor of equal weight.

Your engineering department will receive the fullest cooperation from ours on problems involving the application of Ribohm to your apparatus.

WARD LEONARD ELECTRIC CO. MOUNT VERNON NEW YORK

Bar-Type Ribohm—

(1) A metal ribbon of appropriate size and alloy (2) is punched and formed into a "U" shaped channel with provision for mounting and extra terminals and, (3) after flattening at the ends, (4) is formed with specially shaped bends into a continuous resistive element.



A TYPICAL APPLICATION OF RIBOHM

Bar-Type Ribohm Resistors are employed in this portable loading rheostat. The rheostat has a capacity of 36 kw. and weighs only 300 pounds complete. (Top and side of cage removed.)

Applying Insulating Materials to Coils and Windings

No. 7 of a Series on Insulating Varnishes and Impregnating Compounds

A discussion of the applications and properties of bakelite and mica as insulating materials in the impregnating of coils and windings

By D. H. Braymer
Consulting Engineering Editor,
Electrical Manufacturing

MUCH research work has been done along the line of producing a gum substance which would effectively take the place of some of the natural gums which have long been used in the making of insulating lacquers and varnishes. However, Dr. Baekeland was the first to invent highly successful synthetic phenolic resins. In bringing this about he recognized that their best purpose was not to duplicate or substitute them for the natural gums but to provide distinctive properties for new fields of service and new methods of application.

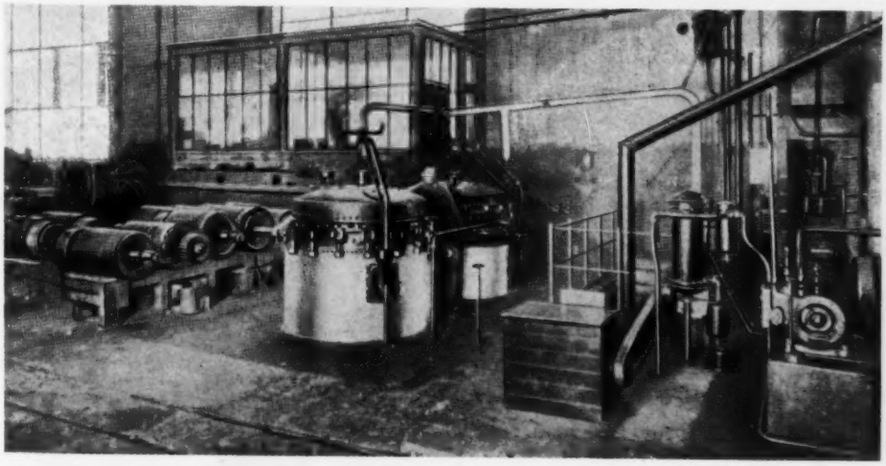
The natural gum varnishes provide final protective properties by slow drying or oxidation in the air. Phenol resin varnishes, on the other hand, provide their best characteristics by being baked for a few hours at high temperatures. In what follows, information on the handling of bakelite varnishes is presented as furnished by the Bakelite Corporation, 247 Park Avenue, New York City.

In its primary or "A" stage, bakelite resinoid can be melted and will dissolve in common solvents such as alcohol and acetone. Further application of heat advances the material by a process called polymerization, to a new chemical composition, and at this point it becomes permanently infusible and insoluble. Its properties in the "A" stage permit its being dissolved and fused, and variously applied in industrial processes as in making of varnishes and the like. Its later transition to a strong, insoluble, infusible mass, renders it peculiarly durable in service.

When bakelite varnish has been applied to a coil or other object, the solvent is allowed to evaporate and heat is then applied, usually by oven baking, in order to convert the resin impregnation to its final resistive and durable state. Normal resinoid impregnation on a coil or winding, when properly heat-treated, should withstand operating temperatures up to 150 deg. C. or 302 deg. F. The makers claim that there is little doubt that the impregnation will withstand even higher temperatures if the excessive application of heat were only during short periods. This insulating material, therefore, provides protection against operating temperatures higher than the limits established by the American Institute of Electrical Engineers, as presented in the table in the first part of this article, which appeared in October Electrical Manufacturing.

In its final state bakelite varnish provides a hard, dense, continuous and uniform protective coating for metal, and when applied to wood or porous ceramic material, it offers both impregnation and surface coating, depending on the method of application, temperatures, etc.

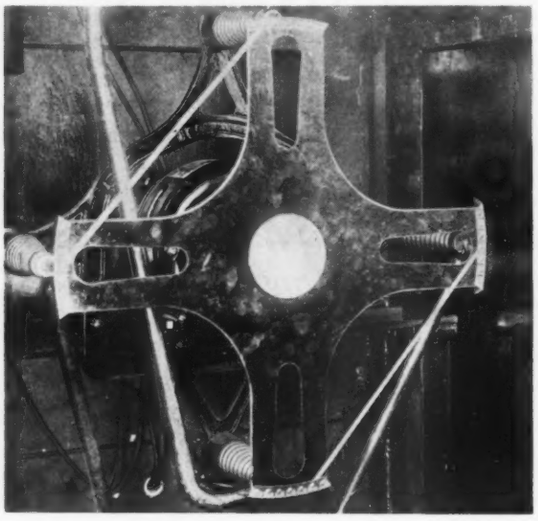
It provides high dielectric strength and from a mechanical standpoint provides a very tenacious and durable bonding. It is not affected by extremes of climate, temperature or humidity. In addition, it is not deteriorated by the presence of oil, organic or mineral acids, or by solvents like alcohol, benzene or acetone, so that it resists the elements liable to be encountered in the operation of electrical equipment. From the standpoint of protection against high operating temperatures as already mentioned, it does not melt at any temperature when properly heat treated. But, since it is characteristically an organic compound, it will char at extremely high temperatures. It can be conservatively stated



Bakelite varnish applied to the armatures of motors and generators serves to insulate the windings and at the same time contributes to the mechanical strength of the unit as a whole. In this view two dipping tanks are shown as they are employed for vacuum impregnation

that its heat resistance is at least 50 per cent higher than that of the ordinary insulating varnishes used for high temperature work.

When used for coil impregnation, the application is somewhat different than in the case of the application of resinoid varnish. In coil impregnation it is usually desired not



A disc type rectifier as it is used in an X-ray machine. It is made of a special high-grade micanite, as it was found that this material and the cross-shape reduced the possibilities of breakdowns in service

merely to provide a protective surface, but to secure insulating effect depending on the operating conditions in service. In addition, impregnation is frequently desired to varying depths in the coil or winding. In such a case the varnish is expected to add mechanical strength to the finished unit as well as the adequate dielectric strength, heat resistance, and corrosive resisting properties, and all of these are well combined by the impregnation process when bakelite varnish is used.

When winding coils for bakelite varnish impregnation it is essential to omit all insulating materials containing oils, paraffin or other non-absorbent tapes or papers. Ordinarily, this varnish is not recommended for enameled wire, but for use with wire covered with cotton, asbestos or silk. To prevent rigidity of lead ends on coils, these leads can be made relatively impervious to bakelite varnish by dipping them in rubber cement.

When applying bakelite resinoid varnish to coils and windings by the dipping process, the following procedure should be followed.

1—Expel moisture from the coils by baking at 255 deg. F. for at least three hours or longer, when the coils are of large size.

2—Heat the coils and immerse in the bakelite varnish for a period of 15 minutes to one-half hour. Sufficient time will be indicated when the varnish ceases to bubble.

3—Remove the coils from the varnish, taking care to withdraw them slowly, so as to insure a smooth uniform coat of the varnish. Drain for one hour and then bake in an oven under uniformly maintained temperature of 165 deg. F. The time of baking will depend on the nature of the coil or winding treated, but for average sizes of coils six hours is recommended.

4—After six hours in the oven, raise the temperature to 250 deg. F. and bake from 12 to 24 hours. Here again the time of baking will be governed largely by the size and construction of the coils. This completes the final treatment for coils and windings to provide the dielectric and mechanical strength and the heat and corrosive resistance that has been described.

For high temperature conditions in electrical machines, mica has been found to be a first class insulating material. Its insulation resistance increases with temperature which is a valuable characteristic for high temperature operation. This is in direct contrast with treated tapes in which the insulation resistance decreases rapidly at temperatures above 212 deg. F. It is unaffected by temperatures far in excess of those encountered in well ventilated electrical apparatus. It is also impervious to static discharges present in all high voltage machines. Furthermore, it is resilient and retains its resiliency indefinitely, thus helping to hold coils tight in the winding slots.

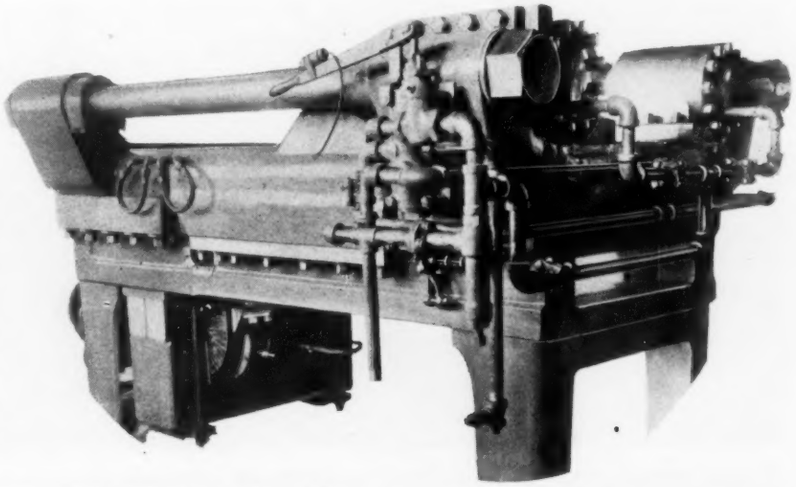
Mica is a mineral obtained in the form of a crystal from which thin flakes can be split. These flakes can be pasted on one side of a sheet of insulating paper or cloth with a suitable varnish in such a way that the joints are staggered, making a flexible paper or cloth which can be cut into the form of tape for use on coils. This flexible mica paper or cloth is also used for mechanical and electrical protection in slots in the form of slot cells or wrappers. Where an indestructible tape or slot cell is required, the paper, or cloth can be omitted and the pure mica used as tape and wrappers, made up as described.

All insulating materials are relatively poor heat conductors as compared to copper or iron. This is equally true of mica and treated tapes. Therefore, the tighter and thinner the wall of insulation, the better the heat radiation from the coils will be. For the lower voltages, the mica wrapper or tape is applied as tightly as possible by hand. But for the higher voltages where the insulation wall must be relatively thick, special machines are used to apply the wrapper under heat and pressure, so as to provide a solid compact insulating covering.

Another high heat resisting insulation can be provided by a combination of mica and asbestos paper. It is usually made up with a layer of mica between two layers of asbestos paper. When these materials are used, the finished coil should be treated with an insulating varnish of heavy body that will not run under high temperatures, and then baked.

When asbestos paper is used with mica, it should not be dipped in bakelite varnish, for the asbestos paper then

(*Continued on page* 254)



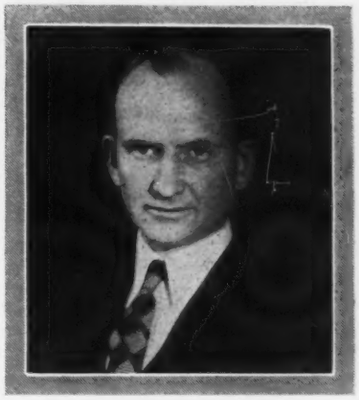
On this high speed electric welding machine, capable of exerting pressures up to 100 tons, bakelite varnish impregnation is used to insulate and strengthen the coils

Magnetic Reluctance of Joints in *Laminated* Cores

Tests showing the relative importance of joints in reluctance of transformer cores are described, and this test information is clarified by a discussion of methods for applying it

By Guerney H. Cole

Engineering Department, Westinghouse Electric & Mfg. Co.



Guerney H. Cole

MOST laminated cores of electrical apparatus are constructed with more than one punching in each lamination. Lack of information regarding the effect of the joints resulting from this type of construction has frequently necessitated neglecting them in calculation involving the magnetic circuit. Generator cores are usually so large that it is necessary to construct them of segmental punchings. In transformers with cores sufficiently small that each complete lamination of the magnetic circuit could be manufactured in one piece from commercial widths of sheet silicon-iron alloy, rectangular or L-shaped punchings are used to avoid excessive scrap. Even in audio transformers, where a complete lamination of the magnetic circuit is often made from a single piece of steel, a joint is introduced to facilitate the assembly of the transformer.

The lap joint (Figure 1) is used most widely at the juncture of the component parts of magnetic circuits. Transformer cores can be assembled more cheaply with butt joints (Figure 2), but such structures have higher magnetic reluctance, higher eddy-current loss at the joint, and additional iron loss due to leakage of flux into structural parts.

The reluctance of joints often can be neglected when the flux density in the core is high, when the length of the magnetic path is great compared to the number of joints, or when there is an air-gap in the circuit, as in reactors or rotating machinery. For structures operated at moderate or low flux density, or for short magnetic circuits, or when the number of joints is large, the ampere-turns required for the joints should be considered. It is not possible accurately to calculate the ampere-turns required to produce a given flux density in a joint even if it is a butt-joint in which the average gap-length of the joint is known, as the joints between some of the punchings will be better than those in other laminations of the core, and hence saturation effects will be produced. The saturation effect will be even more pronounced for lap joints. The test results given below make possible the estimation of the joint reluctance with a fair degree of accuracy. As the reluctance of the joints generally is not a large proportion of the total, great accuracy is not required.

Rings 10 in. outside diameter and 7.5 in. inside were punched from 0.014 in. thick electrical sheet steel containing approximately 2.5 per cent silicon. With these dimensions, the distribution of flux across the width of the specimen was fairly uniform and the mean magnetic force differed by less than 1 per cent from the magnetic force required to produce flux at the mean radius. The permeability of this material differed but little from that of 4 per cent silicon-iron alloy, and hence the results are applicable to structures built of almost any silicon-iron alloy, inasmuch as other factors have a greater effect than the differences in permeability of the materials. A core containing 22 pounds of the punchings was wound with a primary and secondary of 100 turns each.

The A.C. ampere-turns required to magnetize these rings were determined for various inductions. After this test, the winding was removed from the specimen and the rings were sheared into semi-circular segments. A second test was then made after the core had been rebuilt with two butt joints (Figure 2). For the third test, the core was again rebuilt using lap joints (Figure 1). In the second and third tests just described, the punchings were assembled very carefully to produce the minimum reluctance obtainable without resorting to a

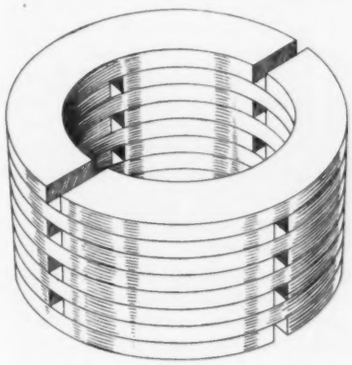


Figure 1

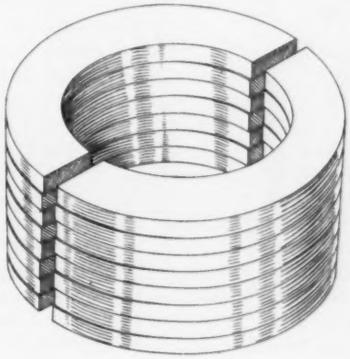


Figure 2

Figures 1 and 2 illustrate the lap and butt methods of stacking laminations. The lap method is the better method, but the butt method is the cheaper

special operation such as the machining of the butt joints. In the fourth test it was intended to simulate the worst conditions that would be found in commercial apparatus having lap joints. The gaps in the lap joints were larger than called for by the test program, being 0.105 in. long.

The exciting ampere-turns required to overcome the reluctance of the joint were determined by subtracting the ampere-turns required for the uncut rings from those required to produce the same induction in the structures built with joints. The values thus obtained were divided by 2 for both kinds of joints to obtain the ampere-turns required per joint. The number of joints in a lap jointed structure might be counted as twice that of a butt-jointed core, but this nomenclature was not used here, as it made a comparison with butt joints more difficult. Figure 3 shows the curves obtained for uncut rings and for one of the structures with joints. Figure 4 gives the data on butt joints derived from the curves of Figure 3, while Figure 5 shows similar information for lap joints. In commercial structures, curve of ampere turns required for the joints will lie between the two curves of Figure 5 but its location and shape will differ in each unit constructed. The broken curve of Figure 5 will probably lie closer to that of commercial structures than either of the experimentally determined curves. It corresponds to a structure built with air gaps that average perhaps 0.01 in. in effective length, although the gaps may appear to be shorter. The butt joint, even though it had been assembled with great care, had an average length of air gap of more than 0.01 in. (0.25 mm.). This is twice the thickness of a piece of heavy paper. However, the burrs on the punchings and the scale made the gap look much smaller. In commercial structures the gap would be larger unless the joints were machined. The length of the gap was estimated by comparing the ampere turns (Figure 4) required for it at high induction with the magnetomotive force (shown by the lower dotted line) required for an assumed uniform gap-length at the same induction. It is evident that some of the punchings made better contact with the other punchings in the corresponding planes, and hence carried more flux than their share until the average flux density became quite high.

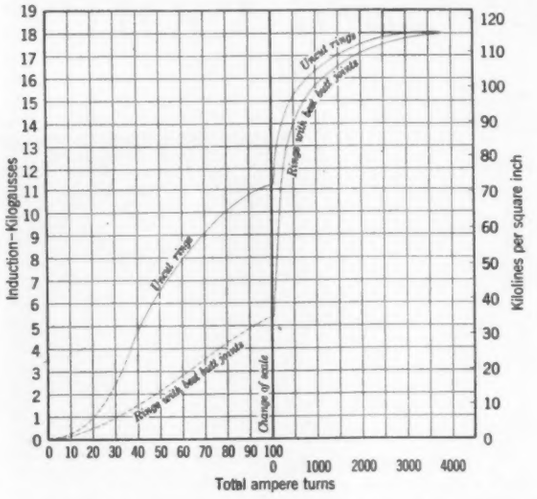


Figure 3 shows the comparative flux densities of an uncut ring and a ring made with the best butt joints. It will be noticed that the horizontal scale of the right part of the curve is increased to show the comparative densities at high flux density

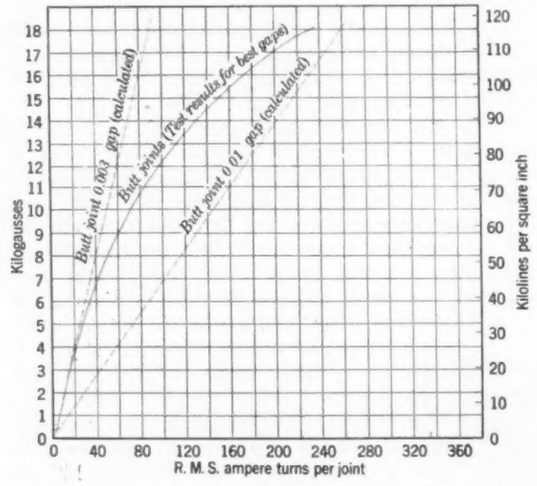

Kilogausses
Kilolines per square inch
R. M. S. ampere turns per joint
Butt joint 0.063 gap (calculated)
Butt joints (Test results for best gaps)
Butt joint 0.01 gap (calculated)

Figure 4. Curves in this figure represent data on butt joints derived from the curves of Figure 3. It is significant that the best gaps have a virtual clearance of from 0.003 to 0.01 in.

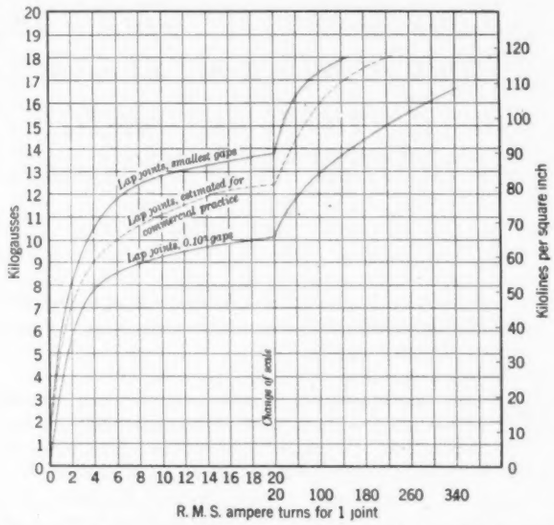

Kilogausses
Kilolines per square inch
R. M. S. ampere turns for 1 joint
Lap joints, smallest gaps
Lap joints, estimated for commercial practice
Lap joints, 0.105 gaps
Change of scale

Figure 5. These curves give information for lap joints similar to the information given for butt joints in Figure 4. The doted curve has been found to lie closer to commercial practice than either of the experimental curves

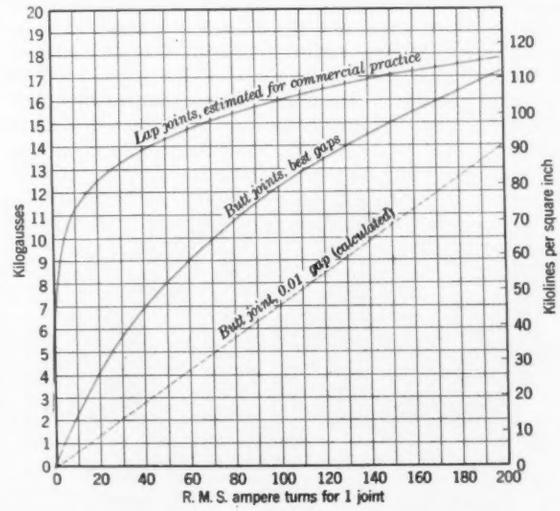

Kilogausses
Kilolines per square inch
R. M. S. ampere turns for 1 joint
Lap joints, estimated for commercial practice
Butt joints, best gaps
Butt joint, 0.01 gap (calculated)

Figure 6. The superiority of lap joints to butt joints is clearly shown in the above curves. This is especially true of the lower flux densities. The dotted curve is the same as the lower curve of Figure 4, with a different horizontal scale

This saturation effect was much more pronounced in the lap joints, as would be expected. At average flux densities lower than 13 kilogausses (85,000 lines per sq. in.), the lap joint even with very large gaps (0.1 in.) required a lower magnetomotive force than the butt joint built with the smallest gaps. At very high flux densities, the magnetomotive force required by the good butt joints was only 50 per cent greater than that of the best lap joints; although the difference was more than 1000 per cent at moderate induction, and even more favorable to the lap joints at low induction.

The effect on the permeability of the steel of cutting the ring in two has been neglected because such a small portion of the magnetic circuit was affected by the cutting operation. The difference in the core loss before and after shearing the ring in two was not measurable and hence the assumption that no appreciable increase was produced in the ampere-turns seems warranted. No account of fringing of flux was taken as the height of the core was several hundred times the length of the gap.

It is interesting to see in Table 1 how transformer designers, from practical experience, found it necessary to adopt types of magnetic structures for short magnetic paths which differed from those which could be used in larger

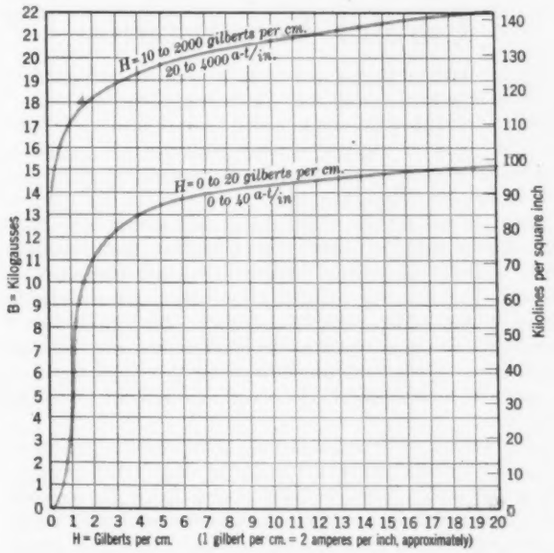

H = 10 to 2000 gilberts per cm.
20 to 4000 a-t/in.
H = 0 to 20 gilberts per cm.
0 to 40 a-t/in
B = Kilogausses
Kilolines per square inch
H = Gilberts per cm. (1 gilbert per cm. = 2 amperes per inch, approximately)

Figure 7 shows the more usual type of magnetization curve obtained by direct current. In using this curve the ampere-turns must be divided by the crest factors obtained from Figure 8, before adding the ampere-turns for the joints

cores. As these transformers were designed several years ago, quantitative information on joint reluctance was not available, yet the table shows that whenever a core was designed which was smaller than one in which the reluctance of the joints was almost comparable to that of the iron part of the circuit, the designers found it advisable to change the type of construction to one having fewer joints or to use joints in which the average induction at the joint was reduced below that existing in a considerable part of the iron circuit. It is probable that the increased importance of the reluctance of the joints in small apparatus is an important factor necessitating designing for lower inductions on small magnetic circuits.

The data of Table 1, showing the relative importance of joints in transformer cores, have been arranged in order of decreasing size of core as measured by weight, volts per turn, and rating of the transformer. The volts per turn of the first unit was 2500 times that of the smallest and the variation in the weight of core was even greater. For large transformers, the effect of joints on the exciting current was small when simple rectangular laminæ were used. For distribution sizes, even though the induction in the joint was lower than for the power transformers, the use of simple punchings would lower the power-factor of a distribution system to an almost prohibitive extent at light loads. The number of joints is cut in half by the use of L-shaped punchings. With L-shaped punchings, the magnetic circuit may be reduced to one approximately one foot long before it is necessary to change the design again on account of joint reluctance. For very small circuits such as trans-

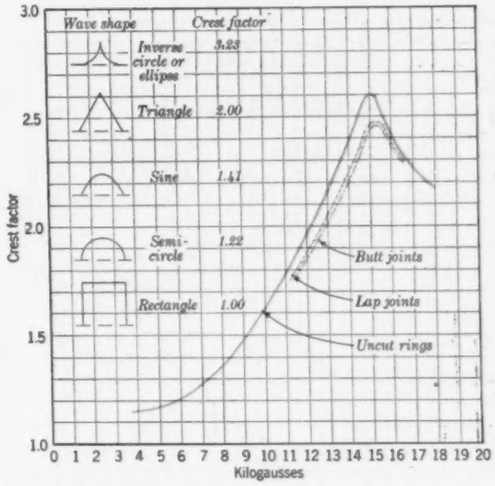


Figure 8. Having applied the crest factors of the curves of this figure as described under Figure 7, the result represents the ampere-turns required for the entire circuit

formers for use in radio apparatus or for bell-ringing purposes, it is usually necessary to resort to a punching having only one gap or joint in the magnetic circuit even though this necessitates a considerable loss of electrical sheet steel in making the punching.

The total exciting current for a magnetic structure may be determined in 3 slightly different ways:

1—From a curve (similar in shape to that of Figure 3) showing the r.m.s. ampere-turns per inch of magnetic circuit, and from the known length of the circuit the ampere-turns for the iron part can be determined. To this is added the r.m.s. ampere-turns required for joints as estimated from Figure 4 or 5 after multiplying the values shown on the curves by the number of joints in the circuit.

2—If the more usual form of magnetization curve ob-

Table 1. Relative importance of number and kind of joints in transformers

Rating Kv-a.	Length of Magnetic Path Inches	Flux Density at Join Kilo gauss	No. of Joints	Type of Transformer	Type of Punchings	Reluctance of Joints In % of Reluctance of Core	
						Assuming best lap joints	Assuming lap joints with 0.1" gaps
15,000	141	14.2	4	Shell	Rectangular	3.6	43
12,000	138	13.6	4	Shell	Rectangular	3.6	53
7,500	97	14.1	7	3-phase, auto	Rectangular	4.0	51
500	150	13.9	4	Long core	Rectangular	4.8	65
500	87	14.1	4	Shell	Rectangular	14.0	232
150	53	13.5	4	Man-hole	Rectangular	13.0	240
75	51	10.3	2	Core	L-shaped	1.1	3.5
50	35	7.8	2	Distributed	L-shaped	6.4	26.0
1.5	15	7.9	2	Shell	L-shaped	18.0	74.0
0.2	15	2.0	2	Voltage	E-shaped	1.8	7.0
0.2	15	9.4	2	Voltage	E-shaped	20.0	280.0
0.01	4.5	12.1	1	Bell-ringing	1-piece with slit	25	...

tained by D.C. (Figure 7) is used, it will be necessary to divide the ampere-turns, calculated from it and from the length of the circuit, by the crest-factor (ratio of peak to r.m.s. values) obtained from curves such as Figure 8, before adding the ampere-turns required for joints. The result represents the r.m.s. ampere-turns required by the entire circuit.

3 (a)—Some designers prefer to calculate the apparent loss (or magnetizing volt-amperes) in a manner similar to that used in calculating the core loss. A curve, such as

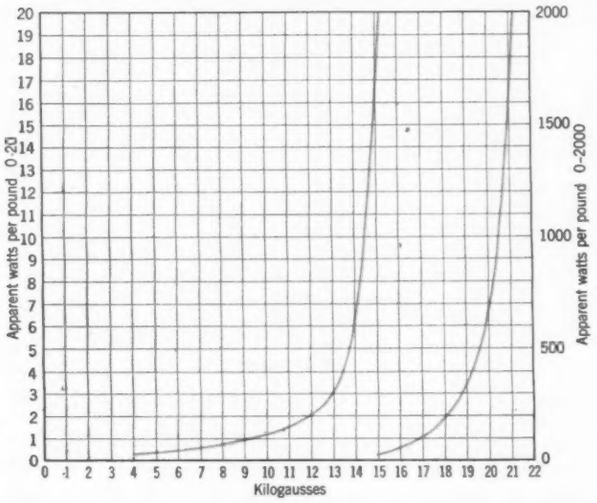


Figure 9. This figure shows the apparent watts per pound of uncut rings, the curve at the left showing the values for comparatively low densities, and at the right for high flux densities

shown in Figure 9, gives the volt-amperes per pound of core, which permits the calculation of the total current required for magnetizing the core from the weight of the core and the applied voltage. To this current must be added that calculated for the joints.

3 (b)—If the total exciting Kv-A, or V-A are desired, instead of the exciting current, the portion required by a core without joints is calculated as given in 3 (a) and added to the volt-amperes, VA, required for the number of joints, J, in the core, as determined by the formula

$$VA = J\,(AT)\,\frac{v}{t}$$

where AT represents the number of r.m.s. ampere-turns required at a given induction for each joint (Figure 3 and 4), V is the r.m.s. voltage of any winding, and t is the number of turns in that winding.

It is not strictly correct to add the volt-amperes or apparent watts calculated for joints to those calculated for the core, as the latter have a power component, while for butt joints this is not true. Generally the resulting error is small in comparison with other variables, as there is usually little difference in the magnitude of the apparent watts and the wattless volt-amperes.

We have shown how the data may be applied in the calculation of the characteristics of a magnetic circuit, but it has other uses. If the exciting current of a large power transformer is found to be 50 per cent high, an engineer can feel quite sure that the trouble is not at the joints of the structure unless the transformer has been in a wreck and had the joints opened to a very noticeable extent. He probably would look for a testing error, or to see if the normal voltage had been applied to only a portion of the full winding. On the other hand, if such an increase occurred in the exciting current of a three-phase distribution transformer constructed with rectangular punchings, it would be highly probable that the increase was due to joints having gaps which were slightly larger than the usual amount.

In an effort to get a fair induction with extremely low magnetizing force in small cores used in special applications, such as very accurate current transformers, hipernik is sometimes specified. Hipernik is an alloy of approximately equal parts of iron and nickel. Its permeability at low or moderate induction is 5 or 10 times that of silicon steel or iron and hence the relative effect of joints is much greater. In such case it is often necessary to use ring punchings without joints or with only 1 lap joint to realize the full benefit of this remarkable and expensive material, even though this involves a great deal of scrap and a more expensive hand-wound coil.

An important point observed in these tests on the reluctance of joints was that the core loss increased approximately 30 per cent in a lap-jointed structure with very poor gaps. This was due to saturation effects in the steel bridging the gaps. The flux density in these bridges is nearly double that in the rest of the core. This results in a very flat magnetization curve (Figure 4) at moderate induction, such as 10 kilogausses (64,500 lines per sq. in.).

Small Losses Are Worth Careful Investigation

The trouble with so many of us is that in looking for losses we look only for the big losses. The big losses are usually found easily enough but on investigating it is learned that the cost of making new installations or alterations would be so great that the plan is abandoned. The initial cost looms up like a mountain.

Little losses, on the other hand, are overlooked because they appear to be so small as to be "not worth bothering with." There is such a thing as devoting too much time to small details, true enough. However, the simple little losses when added together amount to more than the single big loss that, because of its bigness, can be plainly seen. Besides, the cost of eliminating the small losses may amount to considerably less than the cost of eliminating the big loss.

For example, a foreman found that a machine wasn't running fast enough. It was 5 per cent slow. He couldn't increase the motor speed because it was made for one speed only. The foreman may not have known it, but in addition to the 5 per cent production loss there was a 5 per cent power loss. The driving engine or motor was doing just as much work as though it were pulling a full load. The actual load of the driven machine plus the power loss due to belt slip was equal to the full normal load without slip.

However, the foreman knew that production could be increased by spending a few cents to treat the belts and make them pull without slipping. Or, he would spend a little more and use some larger pulleys.

He, therefore, suggested the improvement. The superintendent, however, had other ideas and told the foreman without investigating the case that everything was all right aside from the 5 per cent production loss. He told the foreman, "If we wanted to increase the speed by that 5 per cent we would buy a larger driving pulley for $30, but it wouldn't pay. It's too much trouble."

There the matter rested. In this case a new $30 pulley wasn't needed at all. About 5 cents worth of belt treatment would have put the belt in proper condition to do full work without slipping.

The superintendent proposed to spend $30 and at the same time continue to pay for the constant power loss of 5 per cent which might amount to another $30 a year, plus the cost of wear and tear on the slipping belt.

Small losses are worth investigating and stopping, if possible, at a nominal expense.

Sheet Steel—Its Uses in the Electrical Industry

No. 8 of a Series of Articles on Common Materials

Due to wastes that often result from unreasonable specifications for sheet steel, the manufacturing methods used with this product should be understood by consumers

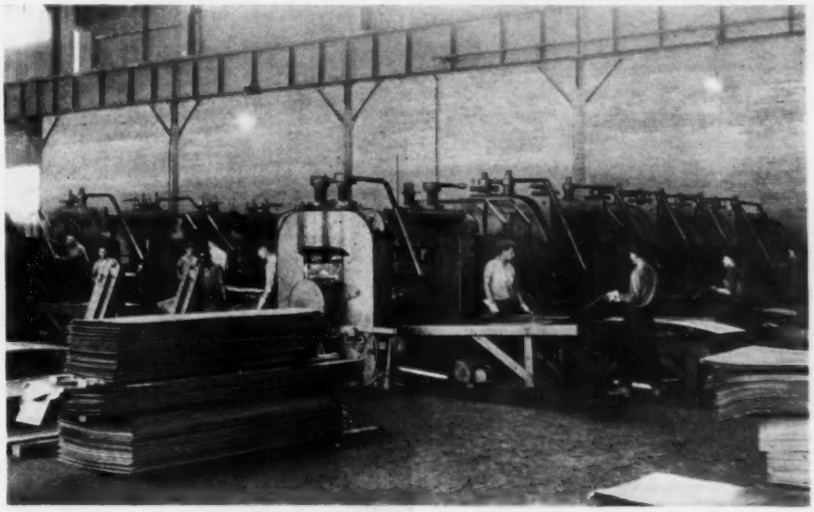
By William Crawford Hirsch

SILICON alloy sheets, used in the magnetic structure of electrical apparatus, have been singled out for the commercial designation of *electrical sheets*, but in addition to these, heavy tonnages of sheet steel, other than silicon, are consumed in the electrical industry. So wide is the use of sheet steel that there are few electrical products in which it is not used in some form or other. One need but think of the large variety of cabinets that serve as housings for all sorts of devices and apparatus. Even in radio receiving sets, with which the use of steel is but little associated, many sets and socket power devices are contained in sheet steel cases. Domestic appliances, such as electric ranges, ironers, many types of air heaters and fans are in part of sheet steel. Industrial and railway lighting fixtures are usually of sheet steel. In recent years electrical consumption of sheet steel has been impressively augmented by the growth in output of electric refrigerators, cabinets, linings and shelves absorbing much sheet steel. Because silicon alloy sheets are used almost solely in the electrical industry, it is relatively easy to estimate consumption of this electrical specialty, which this year will probably approximate 350,000 net tons, but because of the widely scattered sources of supply: mills, warehouses and jobbers, none of which segregates the tonnage of ordinary sheet steel sold into electrical consumption, it is impossible to make any worth while estimate of the total sheet steel consumption in electrical manufacturing. That the electrical manufacturer is among the sheet steel industry's best customers, is certain.

Recent developments in the steel industry, especially the introduction of improved rolling processes in both sheet and strip mills, have brought about in some quarters a movement for reclassifying products. Strip mills today roll material much wider than was the case in years gone by, 24-in. being looked upon as nothing out of the ordinary. In some sizes and gages sheets and strip steel not only compete with one another, but also with plates, by which name material more than ⅛ in. thick is usually designated, aside from the fact that there is a distinction between the rolls used in sheet, strip, and plate mills. Reform advocates would drop all reference to whether a piece of steel has been rolled in a sheet, strip or plate mill, and designate the product of all as "flat rolled steel." For the present, however, sheet steel continues to be the ordinary, commercial designation for the product of sheet mills.

Before proceeding to an outline of the evolution of sheet steel, it may not be amiss to say a word with reference to "sheet iron." Very often the term is used loosely and applied to what is really sheet *steel*, but there is sheet iron rolled or hammered from puddled or otherwise purified iron with so low a carbon content, as to entitle the product to the designation of iron. Strange to say, in the making of a well known brand of this material, carefully selected steel scrap is used with high-grade pig iron, the carbon content of the mass being virtually eliminated by smelting at extremely high furnace temperatures.

Sheet mills begin their operations with the sheet-bars, a convenient shape of steel for rolling sheets that has been produced from steel ingots by rolling in a so-called blooming mill. A sheet mill may be integrated or non-integrated in the matter of its sheet-bar supply, i.e., it may be equipped with the necessary furnaces and primary rolls to make its own semi-finished material or it may buy it in the open



Re-squaring shearing is applied to a grade of sheets known as metal furniture stock. These are black sheets, full cold-rolled, pickled, double annealed, and stretcher leveled. The shearing process removes the grip marks on the edges left by stretching

market. The bars are then broken down on a roughing mill from which they go to the finishing mill, having been roughed down to the gage that the finishing mill will take, successive passes, interrupted by reheating in the sheet furnace, finally resulting in the elongation of the bars into sheets of the desired gage, known as "red hard sheets" that are then annealed to eliminate the strains set up in rolling. Reannealing and cold-rolling to refine the grain of the metal, enhance its tensile strength and hardness and to give it a smooth, glossy surface as well as pickling in suitable acids to remove all scale, are some of the methods employed to produce quality sheets.

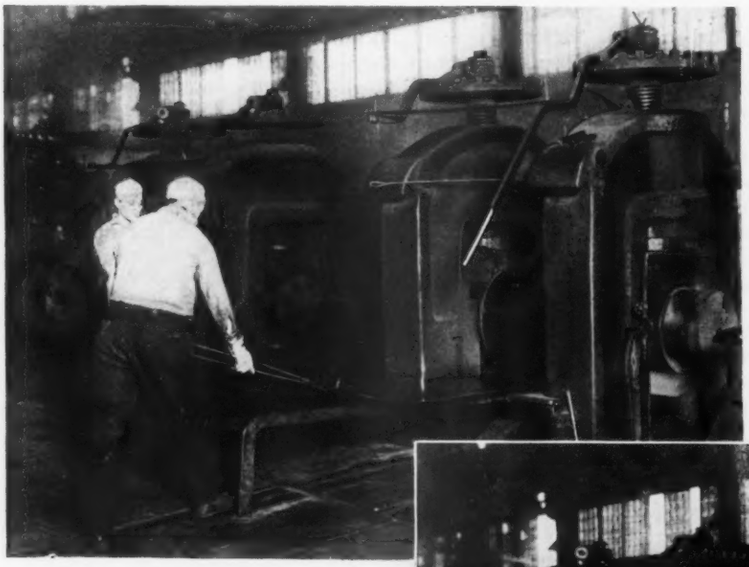
The method of rolling sheets, briefly outlined in the foregoing paragraphs, is now undergoing a transformation, due to the coming of what is generally referred to as "the continuous sheet mill," although authorities say that the development is an outgrowth of the strip-mill rather than of the sheet-mill. Some very remarkable statements have been made with reference to this mechanical innovation, one engineer recording the rolling of 225 tons of sheet steel 17½ in. wide in an 8-hour shift and on wider sheets an output of 1 ton per minute, performances that virtually compare with the productive capacity of the non-continuous mills as does the airplane with a stage coach, or a Zeppelin with a sailing vessel. Steel manufacturers are not saying very much about what they are doing in connection with the installation of continuous sheet mills. In many cases the principle of the continuous mill is being modified, so as to insure economies without calling for too heavy investment, while other rollers, with their particular product in mind, are adopting certain features of the innovation. Aside from the production economies that have been and continue to be effected through the coming of the continuous rolling process, the indirect influence on the industry as a whole has been marked. Whereas the amount of labor required in the old-time sheet mills was notably prodigious, it is now steadily declining, and this in the face of an impressive increase in output. Short cuts, conveyors, and automatic devices of all sorts have released hundreds and hundreds of men for productive work in other fields. Sight must not be lost, however, of the heavy capital investment which this making over of the sheet-rolling industry has called for and continues to call for.

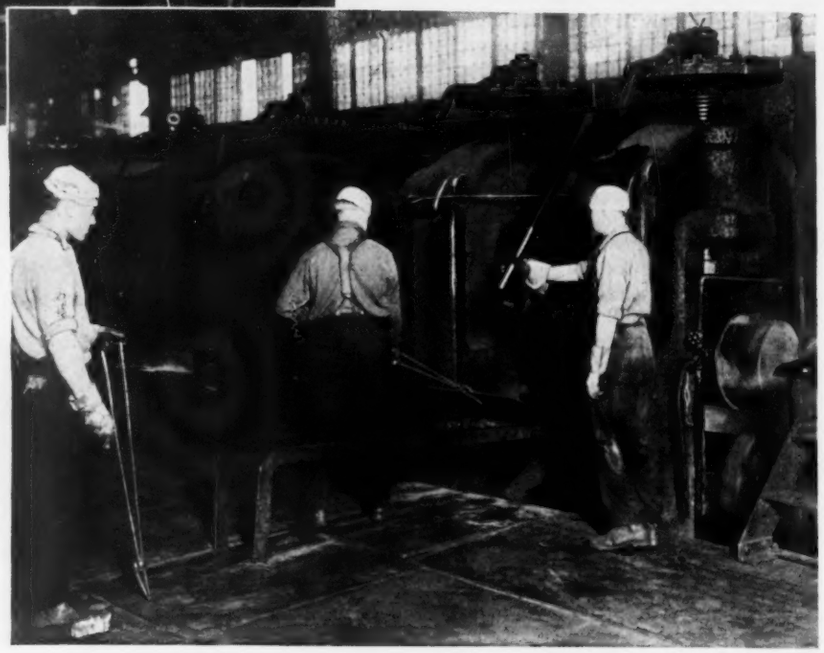
Black sheets come either box annealed or open annealed. Box annealing means that the sheets were protected from oxidation in the annealing process by being inclosed in a metal box. Artificially oxidized sheets are used in some types of electric ranges. There is also a deoxidized finish. Black sheets are quoted on the basis of No. 24 gage at so much a pound, f.o.b. Pittsburgh or other producing markets. The base quotation pertains to one-pass cold-rolled sheets. While larger sheets have been rolled, 42 in. appears to be the normal maximum width.

Blue annealed sheets, so called because the annealing method gives them a bluish-black appearance, are quoted on the basis of No. 9 and 10 gage. Sheets for deep drawing are cold-rolled and pot-annealed. Perhaps in no other description of sheet steel is what one might call good parentage more essential than when it is to be used for deep drawn parts. Unless the chemical composition of the original ingot metal has been closely controlled, trouble is likely to ensue in the drawing. Very often pickling brings out pin holes in the sheet, if the ingot was not sound.

For the purpose of retarding corrosion and improving the physical properties of sheet steel, copper and other alloying mediums are introduced in small quantities in the steel intended for sheet bars, and the market affords a considerable variety of such rust-resisting alloy sheet-steel.

In a class by themselves, of course, are the





ABOVE and to the right are shown hot rolling processes. Sheet mills begin their operations with the sheet-bars, a convenient shape of steel for rolling sheets, which have been produced from steel ingots by rolling in a so-called blooming mill. The bars are then broken down on a roughing mill from which they go to the finishing mill, having been roughened down to the gage that the finishing mill will take. Sheets of desired gage are called "red hard"

silicon alloy steel sheets known as electrical sheets. The silicon content of these sheets ranges from 0.05 per cent in special armature sheets to 4.25 per cent in transformer core sheets. The rolling of silicon sheet steel involves considerable difficulty. A steel containing 2 per cent silicon rolls very "dry." Annealing and reannealing, to overcome the stresses resulting from rolling, are resorted to. Much material has to be trimmed off with the squaring shears because of its tendency to roll ragged and uneven at the edges. The principal demand for electrical sheets is for 22 to 30 gage, widths ranging up to 42 in. and lengths up to 144 in.

Special grades are made for different applications: dynamo, motor, armature, pole, rotor, etc. Electrical sheets are sold with their watt loss specified as so much per kilogram of metal. Up to a certain point, watt loss is diminished proportionate to the silicon content, but when the percentage of silicon used in the different classes of electrical sheets is increased, not only is there a marked tapering off in the efficacy of silicon as a watt loss preventative, but blanking operations become much more difficult. Sheets with 2.5 per cent silicon content are considered non-aging. Where permeability and physical strength are more important than core loss, sheets with a lower silicon content and slight aging are used. Electrical sheet producers strive for as pure a product as possible, for correct grain structure and a scale-free surface, all of which properties tend to reduce the electrical manufacturer's cost for blanking and assembling. The price of electrical sheets depends upon the special properties demanded by the buyer and the tonnage involved in individual contracts.

This view shows two sheet steel annealing furnaces. Black sheets come either box annealed or open annealed. Box annealing means that the sheets were protected from oxidation in the annealing process by being inclosed in a metal box

A grade of sheets known as metal furniture stock consists of a good quality of black sheets, full cold-rolled, pickled and double annealed, followed by stretcher leveling and re-squaring. Stretcher leveling is highly desirable in this class of sheets. By the same token, stretching or patent leveling, which actually stretches the metal slightly and thus diminishes its elasticity, is not advisable in sheets used for deep-drawing. Re-squaring shearing removes the grip marks on the edges that result from stretching. Metal furniture sheets are quoted on the basis of No. 24 gage, and in two grades, A and B. Some manufacturers designate grades in the order of degree of finish, as for instance, "locker," "special locker" and "furniture."

As demand develops for certain finishes, sheet rollers develop special grades most suitable for particular finishing operations. So, for instance, the marked increase in recent years in the demand for vitreous enamel finishes has resulted in sheet stock especially suited for the superimposition of the porcelain enamel.

While porcelain-enameling, japanning, etc., are finishing operations carried out either in the plants of specialists or in departments operated by sheet consumers, the coating of sheets with zinc, tin, and tin and lead, resulting in so-called galvanized sheets, tin and terne plate constitute part of the sheet steel industry's activities, and sheets with these metallic coatings are standard products of the majority of sheet-rolling mills.

The matter of rejections of anything but absolutely perfect sheets, when it comes to the higher grades of material, is one of the pressing problems, affecting both producer and consumer. On this subject, George H. Charles, president of the National Association of Flat Rolled Steel Manufacturers, recently commented eloquently thus: "It is now possible to take flat rolled steel, deep-draw it into graceful and intricate forms and obtain unprecedented beauty in surface and color and unthought of utility in combinations of lightness and strength, but it is another thing to take two tons of iron ore, a ton and a half of coal and half a ton of limestone to produce the perfection in texture, tensile strength and surface demanded today. Ordinary quality is rejected, extraordinary quality is questioned, superlative quality is merely acceptable, perfection is demanded, and nothing under the sun is perfect. While it is praiseworthy of Americans that their demand for progress and improvement in performance and style is insistent and insatiable, there must be reason in all things, and these admirable qualities must not lead to extravagance, waste and uneconomical losses. Imagine the economic loss imposed by some specifications and standards of inspection when a piece of flat rolled steel 20 x 40 x 100 is rejected because of a minute spot not much larger than a pinhead —4400 square inches of steel rejected either at the mill or in the factory because of less than one-quarter of a square inch of minor imperfection."

Especially when it comes to sheets for deep-drawing, the specifications must take into consideration the always present factor of limitation. Another problem that is to the front in the sheet industry is the elimination of misunderstandings which result from the use of half a dozen varying gage systems with the exclusive use of the U. S. Standard Gage recommended as remedy by leading steel producers.

Mill prices for standard descriptions of sheet steel apply to round tonnages. Smaller quantities are obtainable from warehouses located in the larger cities. Warehouse prices for standard descriptions are quoted in the trade press f.o.b. the cities in which the warehouses are located.

Statistics for the year indicate that sheet steel consumption will reach a new high mark in 1928. This growth is chiefly attributed to the increased demand from automobile manufacturers. Leading sheet producers say that the growth of sheet steel consumption in the electrical industry has been fully as remarkable.

Furthermore, the use of sheet steel in the production of furniture, metal partitions and shelving is ever increasing. This is made evident from recent reports of the U. S. Department of Commerce. These indicate that exports of sheet steel for these purposes alone, have increased more than $100,000 in the first nine months of this year.

Station G-A-G-E, Editor Speaking

Stanley A. Dennis, Editor and Assistant to the President

And Now, Let's Forge Ahead

THE battle of the ballots has stilled. The tumult and the shouting are dead. Out of the barrage of political appeals the loud speaker has returned to normalcy. Somewhere somebody may still be giving somebody else a long ride in a wheelbarrow in payment of an election wager. But business has gone back to work.

Rather, business never left its machines and its desks. Before the election business agreed, with President Coolidge, that nothing to stop the onward march of prosperity was in sight. Now, with the election added to the pages of history, business, with a sigh of relief and a tug at its belt, is toeing the mark for another spurt under the cooperation and encouragement of a President who has pledged himself to keep government out of business but always in its service.

This year the commercial qualms which have characterized many electioneering periods in the past were conspicuously absent. Even Wall Street, sensitive to every trace of news which might push the barometer of business lower, distinguished itself by keeping its head and refusing to act like a fidgety old woman in a traffic jam. The ingenuity and vigor of sound business policies has developed a prosperity which is stronger than politics. Always business is its own best saviour. And now for a long pull all together.

What's in a Name?

A PRIZE of $250 is offered by the molded insulation section of the National Electrical Manufacturers Association for a new name for the class of products commonly known in the electrical industry as molded insulation, and which in the announcement of the prize contest are defined as "any substance composed wholly or in part of an artificial gum, capable of setting into a hard, non-softening body." What the sponsors of the contest are after is a short, snappy coined word on the order of "rayon," which is considered in textile circles as a model word-concocting job. The name that is to be chosen for molded insulation is not to be based on the raw materials now used, "as they may change as the industry develops."

Little argument is needed to prove that molded insulation falls short of being an ideal designation for the class of material known under that name. It is cumbersome and technically a very loose definition. Porcelain and rubber are also shaped by one or another form of molding and used as insulation. This also applies to glass. For all that, however, when one mentions molded insulation to an electrical manufacturer he visualizes at once the class of molded products to which commercial usage over many years has restricted the designation. Usage is even a more powerful factor in the language of business than in ordinary speech.

It is ten years since the American producers of slab zinc disowned the designation of *spelter* for that metal which had been commercially known by that name for more than a century. The change of name was prompted by a desire to enhance the esteem for the metal's purity that would result from conferring upon it the name of the element. For several years afterward, leading market publications would append the parenthetical explanation of spelter to every mention of zinc, so that the reader would know what was meant, and even today, although in the United States the name *spelter* has become obsolete and consumers have become thoroughly accustomed to its designation as zinc, it is necessary, in correspondence with England and the British dominions and colonies, to explain when zinc is mentioned that *spelter* is meant, for in the London market, of greatest importance to American producers, zinc is still *spelter*.

Many individuals have patronymics and given names that are more of a liability than an asset in their business or professional careers, yet hardly one in a million ever thinks of a change of name. It is the label by which we are known to the world, and a change might impair the readiness with which we can be identified, and this may mean a loss to us. Raw materials and parts offer an unlimited field for reform in the matter of nomenclature. One need but think of fibre, which means one thing to the electrical manufacturer and quite another to the textile industry. And yet, the mechanical or vulcanized fibre industry has done exceedingly well and continues to grow by leaps and bounds in spite of that which language purists would call a handicap.

The explanation for the acclaim that has been given to the word "rayon" as designation for a class of cellulose textiles lies in the fact that these products are of relatively recent birth. Artificial silk was a stop-gap name that was obviously misleading and an infringement on the rights of the lowly worm that alone produces silk. It may be said that these cellulose products, now known as rayon, never had any other name, and were given the name of rayon when they first came upon the market as a commodity of first-rate importance. And yet, one of the most prominent manufacturers refuses to call his product by that name.

We are living in an age in which commodity names can be synthetically traditionalized through high-power advertising. Choice of a new name for molded insulation is relatively easy. Its success depends entirely upon the appropriation for advertising made to "put it over."

The Franklin Plan

ANNOUNCEMENT of the launching by The Society for Electrical Development of a national plan for the promotion of industrial and commercial lighting should engage the thoughtful attention of all manufacturers of lighting equipment for factory, shop, store and office. If carried through successfully, as one may expect that it will be, the plan should greatly stimulate the sale of such equipment. The newly launched activity is to be known as the Franklin Plan. It is a companion activity to the Red Seal Plan for the promotion of adequate wiring in the home.

The new plan represents an effort to develop a similar standard of adequacy with reference to industrial and commercial lighting. It will promote the acceptance of the Franklin Specification. The original Franklin specification was developed by the Electric Association, Chicago. R. Bourke Corcoran, manager of that association, reports that more than 200 installations have been made in a little more than two years, and that the original

specification received the hearty support of the architects of Chicago and vicinity.

Just as installation under the Red Seal procedure is followed by inspection and certification, so will a similar procedure be developed under the Franklin Plan. The new specification will be national in character, under copyright by The Society for Electrical Development, and will be applied locally by either central station or local league or both acting under license issued by the society.

To manufacturers making industrial and commercial lighting equipment, to central stations and to contractors installing the equipment the announcement of this plan should come as good news. The plan itself seems to have been launched without certain handicaps that have attended the pioneering of the Red Seal Home idea. The latter plan is still in the throes of an effort to set up a national standard, and can be applied only where a local league is in operation. The Franklin Plan starts without these two handicaps. It should show quicker results than has the Red Seal Plan.

Another fact also needs emphasis: The Red Seal Plan was adopted by the society before its reorganization. The Franklin Plan has been adopted by a board of directors officially representing the major associations of the four branches of the industry. It is thus endorsed on behalf of the entire industry, and these associations endorsing the plan through their officers sitting on the board of the society should feel a definite responsibility for promoting immediately this new plan for reaching the industrial and commercial market for electrical service.

Buy Motors on Performance

ALTHOUGH the electrical industry stands high among the industries that are making an honest effort to establish and maintain certain minimum standards of performance for their products, it is not yet entirely safe in every case for the manufacturer of a motor-driven product to buy motors on the claims of the motor manufacturer alone. Practically the only way to get the right motor, the one that will drive the machine properly, most efficiently, and give the longest life per dollar of investment, is to buy from test results.

When the manufacturer samples the motors he is thinking of buying and tests them in his own plant, he has a far better basis for choice than when he trusts entirely on the claims made by the motor manufacturer. When tests are completed he knows whether the motors thus tested will drive his machine or not. The following excerpt from the book, "Your Money's Worth," by Stuart Chase and F. J. Schlink, shows what the maker of motor-driven machinery and appliances may find when he goes into the market to purchase motors:

"In 1925 sixteen makes of small motors, such as are used on washing machines, vacuum cleaners, etc., were tested at the University of Michigan on behalf of one of the large power companies. Of the sixteen makes, twelve failed to comply with the standards of the American Institute of Electrical Engineers, the Electric Power Club (the manufacturers' organization at that time), and the National Electric Light Association. Seven makes were found to be seriously below standard. Professor Bailey, who conducted the tests, says: 'One cannot help drawing the conclusion that many of these motors were built to meet a price rather than to give excellent performance.' This case shows what may happen even in a field—electrical equipment—which ranks high in its efforts to maintain quality standards."

Naturally, not all of the motor manufacturers are making motors which fall below these standards, but what assurance has the manufacturer of a motor-driven product of getting the motor he needs unless he has at hand the results of test data to guide him? Motor manufacturers' literature seldom contains all the information necessary to a choice; sometimes it actually contains misleading statements; and too often the data given is general rather than specific.

Protection for Man, Motor and Machine

IN all lines of manufacturing, any automatic machine that can be employed to reduce production cost is seriously considered whenever the production rate of such a machine can be used fairly continuously. This tendency toward automatic machine operation is creating a growing market for automatic control of all motor drives, to the extent that in many large plants the individual machines are started and stopped by pushing a button These automatic starters for motors are frequently referred to as push-button starters as contrasted with hand-operated starters, and the push-button control is mounted so as to be a part of the machine control convenient to the operator.

This development in the installation of automatic motor starters convenient to the operator is bringing about something more than mere convenience in the stopping and starting of motors. It is bringing into the field of machine operation protection for man, motor and operated machine. This automatic or push-button starter has eliminated the hazard of the open knife switch and has made it unnecessary for the operator of a machine to come close in contact with a live electric circuit where carelessness or ignorance of the danger might prove fatal. All such starters can now be obtained with protective devices such that injury to the motor controlled is prevented on account of overloads, failure of service voltage or other unusual operating conditions to which these protective devices will automatically respond. Furthermore, when these protective devices operate and disconnect the motor from the circuit, protection for the driven machine is also provided and a warning given of trouble that may be located in the machine itself. This trouble may show up as overheated bearings causing excessive friction load, excessive feeding or clogging of some part of the mechanism, the dragging of brakes and the like. In fact, almost anything that will cause a motor to operate off its predetermined schedule of overload or speed will be taken care of by the automatic or push-button starter when properly provided with its simple protective devices.

Safeguarding machines from damage through uncontrollable failure of some part to function properly is a conservation of considerable investment in most instances. But safeguarding the life and limb of operators and the prevention of industrial accidents is equally important as a management problem in maintaining full-time operation of skilled workers, in improving plant operating conditions and in eliminating company liability for injuries to their workers. The contribution to these ends which the automatic motor starter provides is relatively inexpensive and not as fully realized as it might be by those manufacturers of machines who still provide hand-operated starters on the electrically equipped machines they make for sale simply because the out-of-date hand starter is a few dollars cheaper. The day is not far distant when a machine equipped with a motor and hand starter will be rejected by the purchaser as strictly obsolete and unsafe for his plant. Those who do not now realize this should correct the situation by taking advantage of the appeal to the purchaser of the automatic feature of motor control in keeping with his thinking in the matter of automatic operation along other lines.

Characteristics That Determine the *Selection* of MOTORS

No. 6 of a Series Discussing Motors of Different Types

Fractional horsepower and the universal type motors have a wide range of applications in the driving of small tools and other devices

BY THEODORE SCHOU
Consulting Engineer, Fairbanks, Morse & Co.

AND

C. P. ROBINSON
Synchronous Engineer, Ideal Electric & Mfg. Co.

FOLLOWING is the concluding article of the series on the Characteristics That Determine the Selection of Motors. In it are discussed the characteristics and applications of fractional horsepower motors, of the single and split phase types, the universal motor and the single phase condensed motor, with the many different uses to which they are adapted.

The first three articles of the series appeared in ELECTRICAL MANUFACTURING for June, July and August and had to do with synchronous motors of various types, while the fourth and fifth articles, published in September and October, treated with induction motors of different kinds.

Particularly significant in the following is the discussion having to do with recent developments in single phase condenser type motors. These, while not as yet in general use, because of increased cost over other types, appear to be meeting the new requirements for fractional horsepower motors.

One manufacturer lists fractional horsepower constant speed motors from 1/8 to 5 hp. This approximately defines the range of the fractional horsepower motor, although such motors are built in larger and smaller ratings for particular applications.

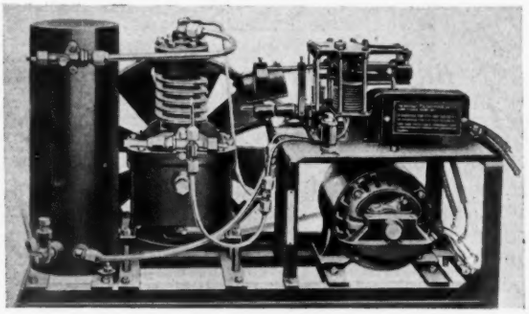


Figure 34 is another view of a repulsion type single phase induction motor as it is employed for driving a refrigerating unit

Practically all of these motors operate single phase. As the single phase motor has not inherent starting torque, different devices have been resorted to, in order to provide starting torque. When the motor reaches its speed, the

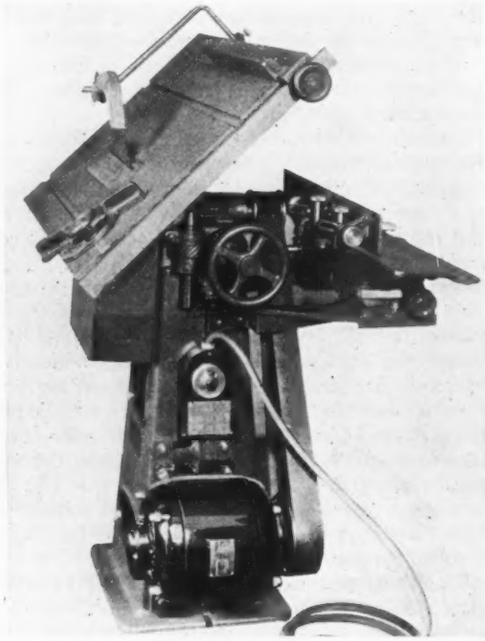


Figure 33 shows a repulsion type single phase induction motor as it is employed for driving a small woodworking saw

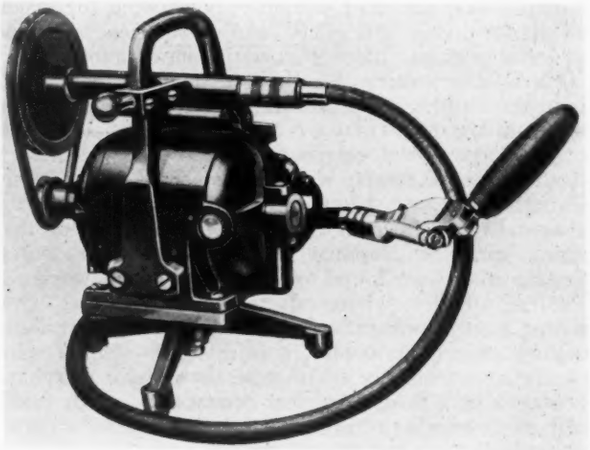


Figure 35 is an illustration of another application of a fractional horsepower motor as it is used on a portable undercutting machine

starting device is usually eliminated and the motor operates single phase.

The two methods employed in starting single phase motors most commonly in use are: 1—The so-called split phase method and, 2—Making use of the principle of the repulsion motor.

Mention will also be made of the single phase condenser motor which though, not commonly in use as yet, undoubtedly has a wonderful future ahead of it.

Split Phase Method—A light starting winding of much higher starting resistance than the main winding is used in connection with the centrifugal switching device. Due

Figure 36 shows the application of a small Bodine universal motor as it is designed integral with the mechanism of a vacuum cleaner

to the higher resistance of this winding, a revolving magnetic field is set up, which though not constant in magnitude, still is sufficient to bring the motor up to speed if the load be small. This arrangement is equivalent to a 2 phase motor and is often used in connection with motors for driving small motor generator sets.

. The required phase displacement may also be obtained by the use of a regular 3 phase winding in conjunction with a non-inductive resistance and a reactance connected in series and then shunted across the line. Two of the 3 phase terminals are connected to the single phase line. The third one is connected to the common junction between the resistance and the reactance. The resistance and reactance are cut out automatically by a centrifugal governor when the motor reaches the correct speed. This arrangement is

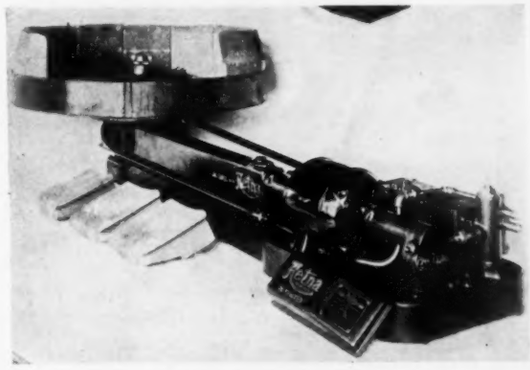


Figure 37 illustrates a split phase induction motor as it is employed to drive the mechanism of an automatic oil burning device

often used for small motors. It is objectionable in large motors due to the high starting current.

The starting curent in connection with the starting devices mentioned is as much as 200 to 300 per cent of full load current, producing a starting torque of only 30 to 40 per cent. Such starting torque, however, is sufficient for many of the applications for which this motor is used. Sometimes a clutch is used which is integral with the motor. This clutch is arranged to slip until about 80 per cent of full load speed is obtained. When the clutch takes hold nearly full load torque may be developed with only about full load starting current.

For small motors such as fan motors, the phase displacement if often produced by the use of so-called shading coils. For this purpose, the stator is constructed with laminated salient poles. About one-half of the face of each pole is surrounded by a low resistance winding short circuited. A shifting field is produced from the unshaded to the shaded portion of the pole and produces sufficient torque for such applications as mentioned.

Repulsion Motor Principle—The best method for starting single phase motors, when large starting torque is required without excessive current, is by use of the repulsion motor principle. Motors started in this way have drum wound armatures with a commutator and are provided with brushes short circuiting the armature along its electrical diameter. The axis of these brushes is slightly displaced from the axis of the stator winding to produce torque. Such motors, when of large size, are usually started with resistance in series with the stator, and are capable of developing large torque. When the slip is about 10 per cent a centrifugal device forces a ring against the back of the commutator, short circuiting each coil of the armature winding. The brushes are then lifted from the commutator and the motor operates single phase.

These single phase motors are used for such applications as, household refrigerating units, sewing machines, washing machines, milking machines, vacuum cleaners, dish washers, fans, phonographs, oil burners, small centrifugal pumps, grinder and polishers, small lathes, laboratory appliances,

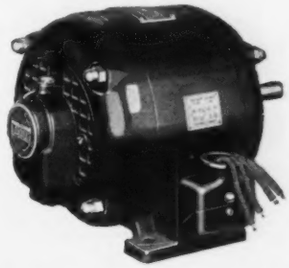


Figure 38 is a view of a small single phase repulsion type induction motor which has many applications in driving domestic appliances

and many other similar uses. Figure 38 shows a typical single phase repulsion type induction motor. Figure 39 shows a repulsion type single phase induction motor driving a small reciprocating pump. A repulsion type single phase induction motor driving a saw is shown in Figure 33. Figure 34 shows a repulsion type single phase induction motor

Figure 39 is another application of a repulsion type single phase motor mounted integral with a small reciprocating pump. This is a typical application of these devices, and illustrates clearly how readily they lend themselves to such installations

driving an automatic household refrigerating unit, and Figure 37 shows a split phase, induction motor driving an oil burner.

The universal type motor is usually understood as one

operating on either alternating or direct current. However, manufacturers of such motors state that in order to obtain the maximum efficiency and output from a given size motor, a winding designed specifically for either alternating or direct current should be used.

The universal motor, then, is a compromise. Most manufacturers list as standard three different windings in each frame one for alternating current, one for direct current and one for universal use.

As this motor is a series type, with a commutator the speed will vary approximately inversely as the load. In this connection, it is, of course, not a constant speed motor. However, by resistance control, or simply by load control, it will reach one speed and operate at that speed indefinitely as long as the load remains constant.

These motors are built in small ratings from 1/100 to 1/10 hp. They have a large application in small appliances, fans, picture projectors, laboratory equipment, etc.

One interesting development is that of a universal motor delivering 1/100 hp. and manufactured by Bodine Electric Company, which is recommended for such duty as home motion picture machines, advertising displays, novelties, etc. Figure 36 shows a Bodine universal motor operating a small vacuum cleaner.

The Single Phase Condenser Motor

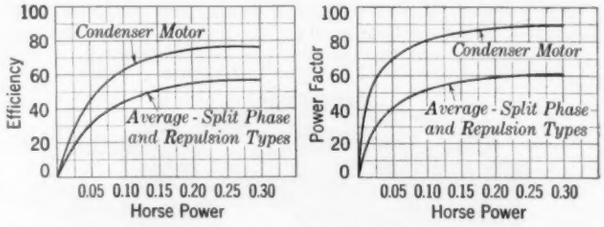
Until recently the efficiency and power factor of small motors were given little thought or consideration. The central stations were not particularly interested, since the connected load was small and was on the line only a small part of the time. Since the introduction of the electric refrigerator and oil burners, requiring an electric motor, the situation has radically changed.

The development of the single phase condenser type induction motor is meeting the new requirements. While not in extensive use as yet, due to the increased cost over other types of motors, it may be only a matter of a few months until the public becomes educated to the advantages of this type of motor.

Figure 41 shows how the efficiency of a condenser type motor compares to the average efficiency of split phase and repulsion type motors of the same rating. This increase in efficiency shows on an average power bill, a net saving of approximately $12 in a year's time.

The condenser type motor costs somewhat more than the repulsion type, and considerable more than the split phase type. It is estimated, however, that the difference in cost need not exceed $10 in the case of 1/4 hp. motors. The saving shown above would easily pay the difference in cost between the two motors, in a year. In addition the condenser type is considerably more quiet than the usual single phase type and causes less interference with radio reception.

Figure 42 shows a power factor comparison which is clearly in favor of the condenser type. By using larger condensers the power factor of the condenser type motor could be increased to 100 per cent, but the cost would likely seem unreasonable. Since the power companies are already realizing the advantages to be gained by the use of the condenser type of motor, it will be only a short time until they are more actively encouraging its use.



Figures 41 and 42 show the efficiency of a condenser type motor and the power factor comparison, which is clearly in favor of the condenser type

With a condenser adjusted to give its best performance when the motor is carrying normal load, it will be found that the starting torque will be around 50 per cent. This torque combined with the characteristics of the motor is satisfactory for many of the loads to which the usual types of single phase motors are applicable. If, however, the motor must start a heavy load, such as an automatic compressor, it will be necessary to use a much larger condenser at starting, and then to reduce this to a suitable capacity for running. This would again introduce the complication of some centrifugal switching device and would materially increase the cost.

It is altogether likely that developments in the design of this motor will proceed in a short time, to the point where cheaper condensers, and quantity production of the combined condenser-motor unit will bring the cost down. Its advantages may then cause it to entirely displace the other types of single phase motors for many applications.

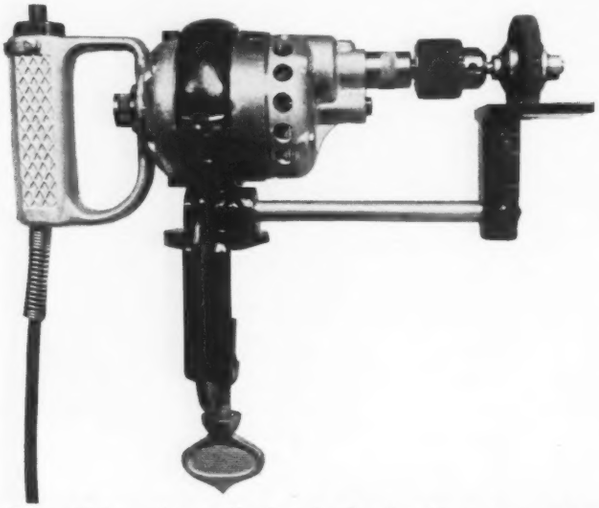


Figure 40 is another application of a fractional horsepower motor as it is used to drive the mechanism of a high speed grinder

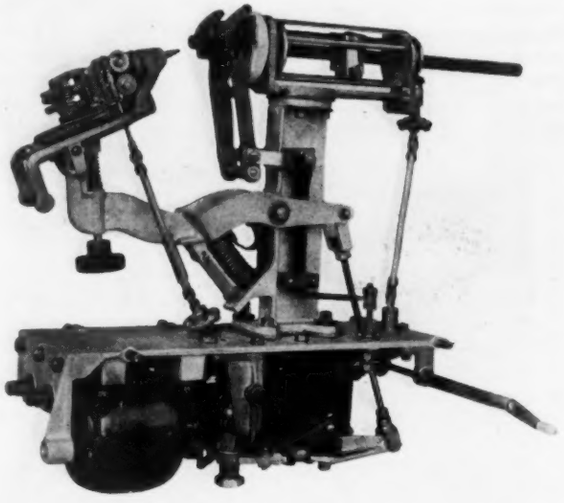
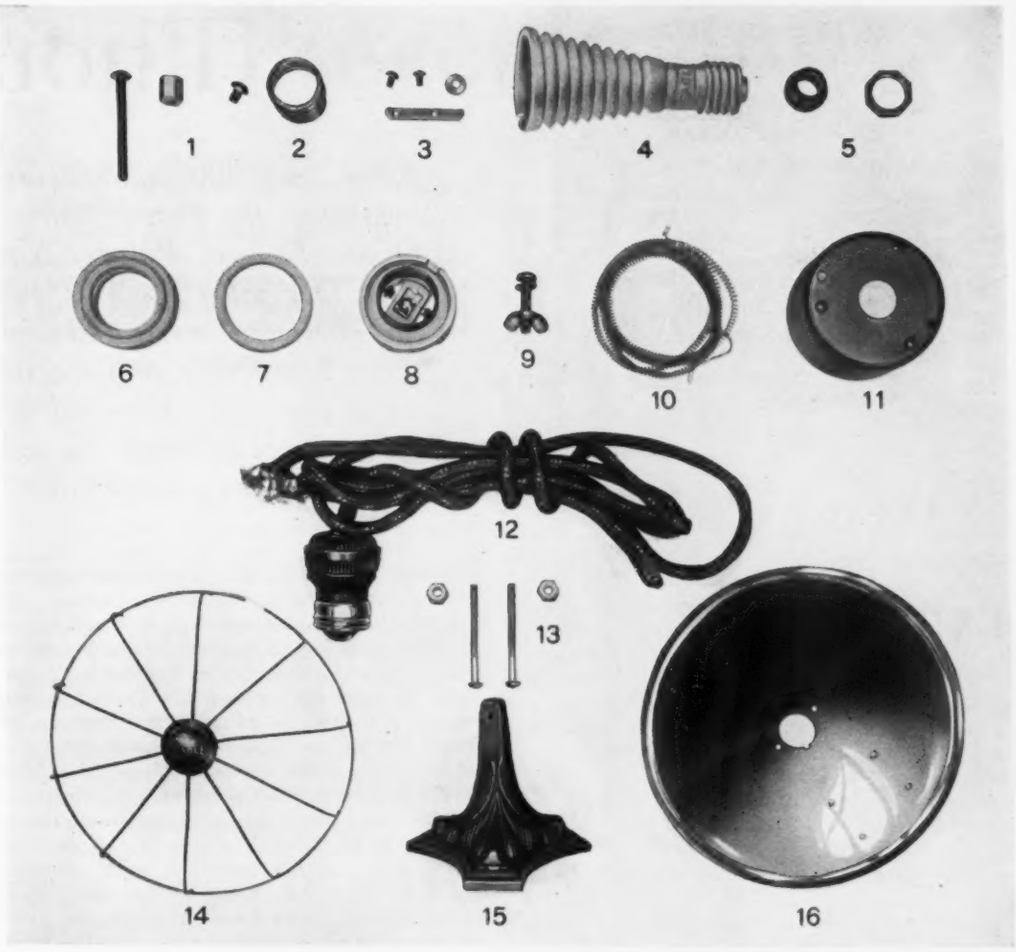


Figure 43 shows still another application of a fractional horsepower motor as it is applied to the arc element of an airway beacon

Air Heater Components



Electrical Manufacturing acknowledges the assistance of the Ideal Service Company, 57 Walker St., New York, N. Y., in the preparation of the illustration above. In 1925, there were 396,000 radiant heaters produced and they were valued at $1,653,000. In addition to this, there were 99,000 convector type heaters produced having a valuation of $374,000

Are you supplying your share of the raw materials and parts required for the annual production of

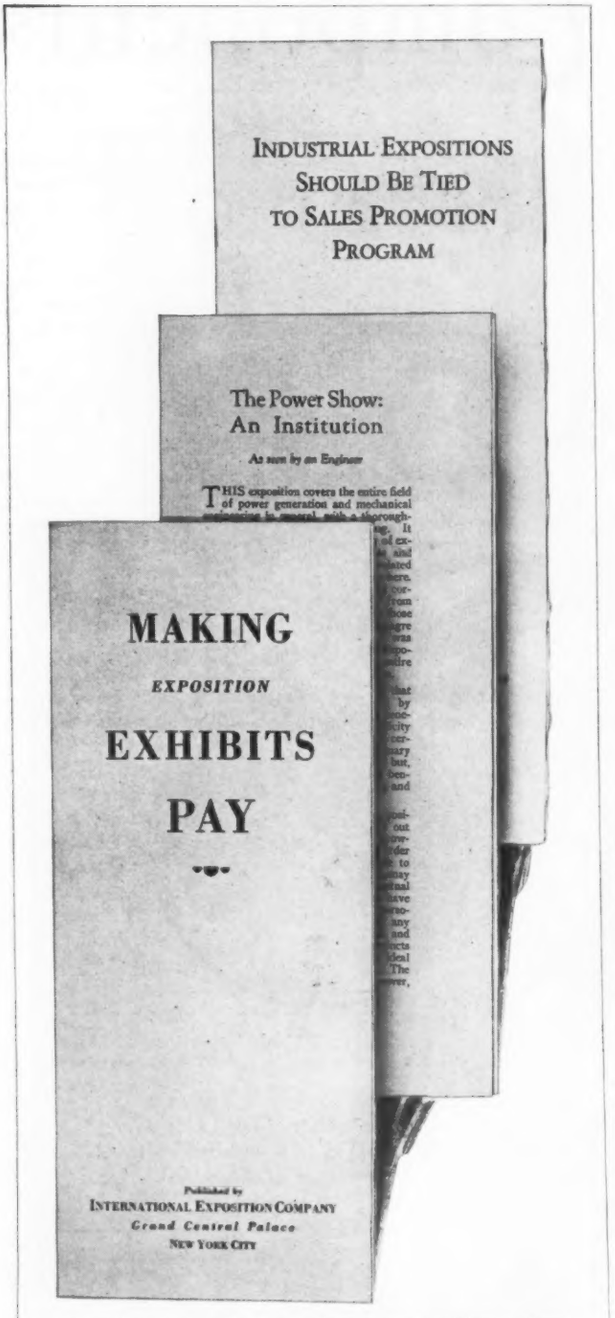
396,000

radiant type heaters, having a valuation of $1,653,000 in 1925?

Part No.	Description	Material	Annual Production
1	Bottom contact bolt	Steel	1,188,000
2	Element screw base	Copper	396,000
3	Side contact screws and bar	Brass	1,484,000
4	Element support	Porcelain	396,000
5	Cord protector	Rubber, brass	396,000
6	Socket top	Porcelain	396,000
7	Socket washer	Asbestos	396,000
8	Socket bottom	Porcelain, copper	396,000
9	Reflector swing bolt	Steel	396,000
10	36-in. element	Resistance wire	1,188,000 ft
11	Socket cap	Steel	396,000
12	Cord and plug	Wire, insulation rubber, brass	396,000
13	Socket cap bolts	Steel	792,000
14	Guard	Steel	396,000
15	Base	Cast iron	396,000
16	Reflector	Copper	396,000

Mechanical Thought

More than 500 *manufacturers will exhibit at the Power Show, held at Grand Central Palace, New York City, December* 3 *to* 8. *It is estimated that between sixty and seventy of these companies manufacture electrical products. Especial efforts are being made to make the exhibits of educational value*



Manufacturers will find in these three booklets a thorough discussion of such expositions as the coming Power Show. Booklets are available at International Exposition Company, Grand Central Palace

PROBABLY one of the greatest problems to the sales executive of power equipment is that of getting a mental picture of his product before his prospects. The salesman depending on photos and written descriptions faces a difficult situation in explaining grades, quality and actual demonstration that often accompany visual presentation.

One of the best answers to such a problem is the Seventh National Exposition of Power and Mechanical Engineering to be held Dec. 3 to 8, 1928, at the Grand Central Palace during the annual conventions of the American Society of Mechanical Engineers and the American Society of Refrigerating Engineers. The members of these organizations come from all parts of the world to compare ideas and problems and to visualize the latest developments in power and mechanical engineering achievements.

In no place in the world is there such a collection of engineering ability as is annually assembled for this meeting. Visitors to the Power Show during the past eight years have increased from a few hundred in attendance to a registered visitors' list of twenty-five thousand and a general attendance of one hundred thousand for the week. The careful study given to the five hundred exhibits last year proved conclusively the value of visual demonstration from a sales standpoint. So satisfying to manufacturers were the results of the 1927 show, that more exhibitors than ever are equipping a booth this year. Renewals of space are so plentiful that once more will the four floors of the Grand Central Palace be divided into booths containing the various types of mechanical equipment that make American industry the wonder of the age.

Executives, Engineers Active at Power Show

THE importance of the exposition is evidenced by the fact that of the twenty-five thousand registered visitors of 1927, over six thousand were officers of corporations or plant owners and sales executives, five thousand were engineers and designers, and four thousand four hundred were technical men bent on visualizing the latest achievements that were on display. Some of the large universities include a tour of the exposition in their student courses and credit all students for such visits.

Those in charge of exhibits promise that the exposition this year will be the thoroughly rounded exhibition of all manner of mechanical and engineering equipment such as it has been in the past. The power section will include displays of boilers, stokers, grates, oil burners, fans, blowers, pipe, valves, and fittings for single or central station work with instruments of precision and control.

The heating and ventilation exhibit this year is more clearly defined than ever and the development of many new features is expected. The problems of the heating and ventilating engineer have kept pace with the progress in the kindred engineering fields.

Of particular interest this year will be the exhibit of belting and related transmissions covering the entire field; and the materials handling section with the actual demonstration of various types of industrial trucks, hoists, cranes, winches and conveyors.

Expression of Creative Spirit of Power Show

A feature of the show this year will be a motion picture program running through the entire week. The films cover a wide field and run from one to five reels. Some of them are to be shown for the first time. Besides those films describing particular manufacturing processes, there are many of a general nature intended to give industrial men a general background and an industrial history of our country. Some of the films to be shown are:

"Electrical Measuring Instruments"—5 reels. This film covers the principle of operation of electrical measuring instruments and the action and movement of the various parts can be seen along with the forces which operate them. This program covers voltmeters, ammeters of the permanent magnet type, movable coil and movable iron types of instruments as well as voltmeters, ammeters, wattmeters of the electro-dynamometer type, power factor, frequency meters, synchroscopes and thermo instruments. This film will be shown by courtesy of Weston Electrical Instrument Corporation.

"Power"—3 reels, which show the amazing growth in the use of power since it was first applied industrially about 150 years ago, traces the development of the steam engine from first crude engines of Newcomen and Watts to those of the present time.

"From Coal to Electricity"—2 reels. This film discloses the story of the operation of electricity from coal showing the operations and the machines used to do the work.

"Conowingo"—3 reels, which show the building of one of the important water power projects of the United States. Located on the Susquehanna River, it is, in its initial development, second only to the plants at Niagara Falls. This is shown by courtesy of Stone & Webster Engineering Co.

"Controlled Heat"—This film shows man's control of fire and the transmission of energy in the form of heat therefrom to work for the comfort of man.

"The Manufacture of Copper and Brass"—5 reels, and "The Making of Sheet Copper"—2 reels; both by courtesy of the Anaconda Copper Co.

Regarding the fundamental purpose of such exhibitions as the Power Show, one writer has said:

"Industrial exhibitions are held in order that industrial delegates may observe the mechanical expression of creative and constructive thought for later use and for dissemination throughout the industry. The many manufacturers who now are approaching the industrial exhibition in this spirit of contributing something to the industry are, obviously, the ones who are getting the most in return."

Progress is after all the fundamental purpose of industry, and industry is more and more favoring the promotion of this common purpose as the sanest road to individual success.

The educative spirit of modern expositions is based on the principle so wisely stated by Dr. Godfrey that "Growth of material wealth comes from preceding growth of factual wealth and of vital wealth (men and women) educated in its use." Gone is the time when industry, used as a collective term, was thought of as some hypothetical body separate from individual industrial organizations. Modern industrial leaders recognize in "industry as a whole" an enormous organization functioning for the benefit of its individual elements. This is a very different attitude from that of "every man for himself," and an attitude which, by its broadness, makes possible such remarkably progressive institutions as the annual Power Show.

Yes, the Power Show is an institution. Since its advent seven years ago it has grown rapidly, and has made improvements comparable to its growth. The earlier shows erred in seeking the sensational by semi-circus methods, and in acclaiming rather than informing. But the modern exhibitor recognizes the severity of the professional engineer as well as the layman, and appeals to both of them by demonstrations that accurately express the true merits of products. The modern exhibitor has learned the secret of dramatizing the mechanical, of appealing to the human interest in mechanical movement. No longer are machines put on the exhibition floor with the secrets of their operation lying quietly concealed behind metal walls. Now they are put into operation, and walls that formerly concealed are cut away so that the operation of the machine's most intricate parts is visible. The exposition of Power and Mechanical Engineering is a huge, living catalog of engineering products and processes.

Less than fifty of the total number of exhibits of the 1927 *Power Show are shown in the above illustration. This will give some idea of the tremendous spectacle this show really is. Four entire floors will be devoted to the* 1928 *Power Show*

What Is the Function of

In the new era of quality production, the function of the wholesaler becomes a subject for careful consideration by the manufacturer

By Roger L. Knight

Associate Editor, Electrical Manufacturing

FAIRLY to discuss the function of the wholesaler, it is first necessary to point out certain evidences of recent and fundamental changes in American industry. For some reason it is generally admitted that American industry recently passed into the so-called "Era of Distribution." The mere extent of this admission is strong evidence that something has happened to business, that some tendency has grown to such proportions that it has effected a basic change. What is this change, and what does it mean?

Walter P. Chrysler has named the "new era" the era of "Quality Production" in contrast to the era of quantity production through which we have just passed. Other writers call it the "Age of Merchandising," the "Era of Marketing," and the "Age of Distribution." All of these imply the crowning of a new industrial king—marketing, in place of the retired king—mass production. This does not mean that in the new era past methods of large-scale production will be forsaken, but rather that the rate of production will be governed by the ability of markets to absorb goods instead of by the capacity of factories to produce goods. There is the basic thing: manufacturing to the order of markets in contrast to marketing to the order of factories, a buyer's market in contrast to a seller's market.

Under pressure of mass production, factories were operated at capacity and their output was marketed by whatever force was required. By the new method the schedule of manufacture will be set by a careful estimation of marketing possibilities. This new method of business is being adopted because only by it can manufacturers avoid profitless business. Setting of manufacturing schedules by factory capacity was successful as long as the goods manufactured were spontaneously demanded by the buying public in quantities greater than or equal to the capacity of the factories. In the era of mass production, markets clamored for goods, but now, and for an indefinite period in the future, goods will clamor for markets.

Industrial leaders are pointing to present trends as evidence that American industry is facing problems that require pioneering. Such problems must be solved with theory tested by experimentation, because there are no precedents to follow. These problems will be primarily marketing problems, and will require that manufacturers become more and more marketing conscious.

1. Merchandising experience and marketing theory both discourage factory control of retail outlets or retailer control of factories

PRACTICALLY, the marketing of goods requires three elements, a producer, a consumer, and some medium of organization for bringing the two together. The producer and the consumer are pretty well defined, but the medium for bringing them together varies widely throughout industry. Some manufacturers sell through retailers directly, some sell to retailers through wholesalers, and still others sell directly to the public. None of these methods is consistent as used. In fact, surveys of present marketing methods betray the existence of chaos.

The best marketing system will fall somewhere between two extremes: on the one extreme a system in which the retailer controls his own factories, and, on the other extreme system, in which the manufacturer controls his own retail outlets. Both of these methods have been numerously tried, and in most cases have failed. But the fact of their failure is much less important than the fundamental reasons for it. In these reasons are found attractive rules upon which to base sound methods of marketing.

One of the outstanding characteristics of modern retailing is hand-to-mouth buying, which depends for its success upon flexibility. The retailer cannot take advantage of quick turnover without having a free choice of the place and time of his purchases. If he owned his own factory, he would necessarily obtain his goods from it, and would thus automatically restrict his buying freedom.

A second and more serious objection to the retailer controlling his own factory is the fact that in such case he would be forced to transfer his loyalty from his customers to his factory. At this time above all other times, this is especially objectionable. By the nature of modern markets, sound marketing must be based on the precept that the consumer be given first consideration in all cases.

The big objection to the manufacturer controlling his own retail outlets is the necessity for an enormous outlay of capital. The amount of this capital will, of course, depend upon the nature of product manufactured. If it is a low priced product made in large quantities and distributed to a wide market, factory control of retail markets is virtually impossible.

House-to-house canvassing is a special case of factory-controlled distribution. This method must necessarily be used on a small scale, because if it were attempted on a large scale it would destroy itself by creating a door-bell nuisance.

Experience speaking for the past, and economic theory speaking for the future, both point to the general truth that manufacturing and retailing are incompatible functions and can only in special cases be carried on by the same organization.

2. For certain types of products, representing a large proportion of the total volume of business, some form of wholesaling function is not only desirable but essential

IN this discussion wholesaling should be thought of as a function and not as any particular organization. The wholesaling function may or may not be carried on by the manufacturer. Many of the large corporations sell through both their own and independent wholesale outlets. The essential characteristic of the wholesaler is neutrality. His position is such that he cannot favor either the manufacturing or the retailing element. Such a neutral medium of contact between the incompatible elements of manufacturing and retailing is evidently essential to efficient distribution of certain goods. The imminent problem is to determine what classes of products can best be distributed through wholesalers, and what are the best standards to adopt in this process of distribution.

Manufactured products can be divided into three general classes: inexpensive products manufactured in large numbers, medium priced products which are relatively specialized, and expensive, high grade products limited in manu-

the Modern Wholesaler?

Table 1.—Results of a questionnaire sent to manufacturers by the Artistic Lighting Equipment Association

1. Is it your sales policy to sell through wholesalers only?
   16 houses—yes
   2 houses—no
2. Do you sell dealers?
   20 houses—yes
   3 houses—no
3. What percentage of your business is with dealers?
   5 houses—none
   2 houses—20%
   2 houses—60%
   2 houses— 5%
   3 houses—25%
   1 house —30%
   1 house —40%
   3 houses—50%
   1 house — 5% to 10%
   1 house —10%
   1 house—very small percentage.
4. Do you sell dealers at a differential or a price that would leave the wholesaler a sufficient margin of profit if he handled the business?
   16 houses—yes
   3 houses—no
   1 house —conditional
5. What average per cent of differential between your dealer price and wholesaler price?
   1 house —20 to 25%
   1 house —20 to 20—10-10%
   1 house —20 to 30%
   1 house —10 to 30%
   2 houses—33⅓%
   1 house —10%
   1 house —19%
   1 house —20%
   1 house —21%
   3 houses—25%
   4 houses—30%
6. What percentage of your business is through wholesalers?
   2 houses—40%
   3 houses—50%
   1 house —60%
   2 houses—70%
   2 houses—75%
   2 houses—80%
   1 house —90%
   3 houses—95%
   6 houses—all
   1 house —most
7. What are your wholesaling discounts?
   1 house —50 & 20
   5 houses—50 & 30
   2 houses—50 & 10
   1 house —40 & 10 on regular lines; 45 on special fixtures
   1 house —60%
   1 house —57%
   1 house —50 & 25
   1 house —60 & 25
   1 house —50 & 10
   60 & 10
   3 houses—50 & 33⅓
   1 house —50 & 10 on commercial light. equip.
   50 & 30 on residential light. equip.
   1 house —50 & 30 on standard pkgs.
   50 & 20 on broken pkgs.
   50 & 25 on standard pkgs. to small jobbers.
8. Do you allow freight discounts?
   21 houses—no
   1 house —yes
   1 house—in a few cases
   1 house—where necessary
9. What are your cash discount terms?
   8 houses—2% 10 prox. net 30
   10 houses—2% 10 net 30
   2 houses—1% 15 net 30
   1 house —2% 10 prox. net 60
   1 house —5% 10 net 30
   1 house —5% 10 prox. net 30
   1 house —no cash discount
10. Do you charge interest on accounts over 60 days———? If so, at what rate?
    18 houses—no
    5 houses—yes, 6%

facture and highly specialized. Almost all of the first class and much of the second class lend themselves to efficient distribution through wholesale channels, but the third class is best suited to some other method of distribution.

This classification must necessarily be broad, and the divisions between classes of products vague, because the practicability of distributing any product through wholesaling channels will depend largely upon particular conditions. It is true that there are goods of the first class that are distributed without the wholesaling function and goods of the third class that are distributed successfully by the use of the wholesale function, but these are exceptions.

G. E. Cullinan, Vice-President of the Graybar Electric Company, points out seven advantages of the wholesaler as follows: "He has a local sales force, a warehouse organization, a knowledge of local business conditions, of the credit standing of local retailers, of their merchandising ability, of their financial conditions, as well as a wide personal acquaintanceship among the townspeople." Along with this, Mr. Cullinan also calls attention to the fact that the success of the wholesaler in serving the manufacturer requires that he have an efficient marketing machine and a volume and diversity of merchandise so that he can combine operations and reduce costs.

Thus it is evident that the efficient distribution of goods through wholesale channels carries a joint responsibility. The manufacturer has a certain responsibility to the wholesaler, and the wholesaler has a certain responsibility to the manufacturer. Just what this responsibility is in each case has not been generally determined; it is one of the problems to be solved soon in the new era of distribution. It will not be solved by any armchair philosopher, but by actual and intelligent experimentation.

3. To determine the best methods of distributing through wholesale channels, the Artistic Lighting Equipment Association has organized a special group of manufacturers whose principal policy is to merchandise their products through wholesalers

AFTER considering the various methods of distributing artistic lighting equipment, the Artistic Lighting Equipment Association was induced to favor the use of the wholesaler. Investigation disclosed the fact that in very few cases did manufacturers abide by any definite standards of practice in distributing their products through this channel. Accordingly, the association initiated a general movement for improving the relations between wholesalers and manufacturers, and for testing the possibilities of this method of distribution. (See Table 1.)

At the annual meeting of the association in January, 1928, a special meeting was held for the purpose of forming within the association a group of lighting equipment manufacturers whose principal policy was to merchandise their products through the wholesaler. This special group was formed with a nucleus of twenty-one manufacturers. Among the particular subjects this group has set out to investigate are: the best method for helping the wholesaler to secure more volume on lighting equipment, simplification and standardization of trade practices and conditions under which fixture manufacturers are selling the wholesale trade, nature and amount of printed matter and catalogue sheets for wholesalers, policies of cash discounts, and the responsibility of the manufacturer to the wholesaler and the wholesaler to the manufacturer.

The association favors distributing electrical supplies

(*Continued on page* 255)

Mechanical Transmission for Motor Drives

*This is the first of three articles having to do with the design and maintenance of the several different types of transmission for motor drives**

IT is the purpose of this article to give: first, the characteristics of each type of mechanical transmission, in order that a more intelligent selection of the proper drive may be made; second, directions for ordering; third, the common rules governing the layout and care of the various types.

The six principal commercial methods of transmitting power from an electric motor to a driven machine are as follows:

1—Belting.	4—Direct connection.
2—Gears.	5—Rope drive.
3—Silent chain.	6—Friction.

Where a speed reduction is involved in the transmission of power, and where it is not necessary to maintain an absolutely fixed ratio between driving and driven shaft, belting is usually the best form of drive to employ. It is simple, inexpensive, and efficient (between 85 and 95 per cent). It has the advantage of slipping slightly under heavy overloads. Because of its elasticity and slip it will absorb a portion of the shock of suddenly applied loads and thus protect to some extent both motor and driven machine. Specially tanned or waterproofed leather belts, fabric, and rubber belts may be selected to meet practically any atmospheric conditions.

As indicated above, belting cannot be used where positive drive is imperative, that is, where the relative r.p.m. of driving and driven shaft must remain unchanged. The upkeep for belting is usually higher than for other forms of transmission, though this cost can be materially reduced if the proper quality of belt is used and the belt is properly applied and cared for. The space required is somewhat greater than for some of the other forms of mechanical transmission.

One of the first points to consider in connection with belt drive is the ratio involved. For good practice the following belt reductions should not be exceeded:

1/15-hp. motor	15 to 1
1-hp. motor	10 to 1
5-hp. motor	8 to 1
10-hp. motor	6 to 1
20-hp. motor	5 to 1
50-hp. motor	4 to 1

Larger ratios of reduction should employ either a double belt reduction, or a worm gear or other suitable form of mechanical speed reducer. The other alternative is the use of a slower speed motor.

The following rules are given for determining pulley diameters and speeds:

These formulas may be applied to any belt drive by substituting the terms "driver" and "r.p.m. of driver" for "motor pulley" and "motor speed." The desired driven speed should be increased 2 per cent in the formulas to allow for belt slip.

1. $$\text{Dia. of driven pulley} = \frac{\text{Dia. of motor pulley} \times \text{full-load motor speed in r.p.m.}}{\text{Rev. per min. (r.p.m.) of driven pulley}}$$

2. $$\text{Dia. of motor pulley} = \frac{\text{Dia. of driven pulley} \times \text{r.p.m. of driven pulley}}{\text{Full-load motor speed in r.p.m.}}$$

3. $$\text{Rev. per min. of driven pulley} = \frac{\text{Dia. of motor pulley} \times \text{full-load motor speed}}{\text{Dia. of driven pulley}}$$

4. $$\text{Rev. per min. of motor} = \frac{\text{Dia. of driven pulley} \times \text{speed of driven pulley}}{\text{Dia. of motor pulley}}$$

It is desirable to utilize the standard pulleys furnished with the motors wherever possible. The use of special pulleys on electric motors is limited by mechanical dimensions, and by the permissible bearing pressure, which, for the transmission of a certain horsepower, increases as the pulley diameter decreases. The maximum pulley diameter is determined by mechanical dimensions. These are in addition to the usual requirements of proper belt speed and width to transmit the power involved.

Belts should not be run at speeds above 5000 ft. per min. Above this speed there is not suffcient friction contact between belt and pulley, owing to the effect of centrifugal force tending to "throw" the belt.

Table I gives the belt speed in feet per minute corresponding to various motor speeds and pulley diameters, and is based on the formula:

$$\text{Belt speed in feet per minute} = \frac{3.1416 \times \text{pulley diameter in inches} \times \text{r.p.m.}}{12}$$

The pulley must be large enough to transmit the horsepower, which ordinarily will not be the motor horsepower rating, but a figure somewhat larger, to take care of possible overloads and peak loads. In ordinary applications 125 per cent of the motor rating may be allowed for a safety factor in the usual sizes of motors.

In general, the product of the diameter and belt width of a special pulley should at least equal the product of the corresponding dimensions of the standard pulley recommended for that size and speed motor. Assuming that the diameters have been tentatively chosen as best for the desired purpose, the horsepower that can be transmitted will depend upon the pulley material, the belt width—its quality and number of plies, the distance between centers, and the relative angular location of the driving and driven pulleys.

Table II shows the horsepower per inch of width trans-

* The information contained in this, the first of three articles, and two additional to be published in subsequent issues of ELECTRICAL MANUFACTURING was abstracted from data published by the Small Motor Division, Industrial Department of the General Electric Company, River Works, West Lynn, Mass.

mitted by good leather belting running over paper pulleys with 180-deg. arc of contact and no slip. For iron pulleys multiply figures given by 0.62, for wood pulleys multiply by 0.41.

To obtain the horsepower transmitted by belts of any width, multiply the figure shown for the given belt speed by the width of the belt used.

TABLE II—HP. Transmitted Per Inch of Width—Leather Belts

Belt Speed Ft. per Min.	H.P. per Inch of Width	Belt Speed Ft. per Min.	H.P. per Inch of Width	Belt Speed Ft. per Min.	H.P. per Inch of Width	Belt Speed Ft. per Min.	H.P. per Inch of Width
Single Belting							
900	1.25	2000	2.78	3100	4.31	4200	5.84
1000	1.39	2100	2.92	3200	4.45	4300	5.98
1100	1.53	2200	3.06	3300	4.59	4400	6.12
1200	1.67	2300	3.20	3400	4.72	4500	6.26
1300	1.81	2400	3.33	3500	4.86	4600	6.40
1400	1.95	2500	3.47	3600	5.00	4700	6.54
1500	2.09	2600	3.61	3700	5.14	4800	6.68
1600	2.22	2700	3.75	3800	5.28	4900	6.82
1700	2.36	2800	3.89	3900	5.42	5000	6.96
1800	2.50	2900	4.03	4000	5.56	....	....
1900	2.64	3000	4.17	4100	5.70	....	....
Double Belting							
900	1.79	2000	3.97	3100	6.16	4200	8.34
1000	1.99	2100	4.17	3200	6.36	4300	8.54
1100	2.19	2200	4.37	3300	6.55	4400	8.74
1200	2.39	2300	4.57	3400	6.75	4500	8.94
1300	2.58	2400	4.77	3500	6.95	4600	9.13
1400	2.78	2500	4.97	3600	7.15	4700	9.33
1500	2.98	2600	5.16	3700	7.35	4800	9.53
1600	3.18	2700	5.36	3800	7.55	4900	9 73
1700	3.38	2800	5.56	3900	7.74	5000	9.93
1800	3 58	2900	5.76	4000	7.94	....	....
1900	3.78	3000	5.96	4100	8.14	....	....

The figures shown in Table II are for regular singly-ply and doubly-ply belts. The values for horsepower transmitted by light belts will be 80 per cent of values shown, and by heavy belts, 115 per cent of values shown. The same values may be used for medium belts.

For a given diameter, the minimum belt width is determined by the horsepower to be transmitted; the maximum width is limited by the possible overhang and the safe strain which may be placed on the bearing.

To obtain the belt width necessary to transmit a given horsepower, divide the horsepower which is to be transmitted by the figures given in Table II, if paper pulleys are used. For iron pulleys, multiply the quotient thus obtained by 1.6; for wood pulleys by 2.4.

Stock sizes of belts increase in width as follows:

From ½- to 1-in. belt width by ⅛ in.
From 1- to 4-in. belt width by ¼ in.
From 4- to 7-in. belt width by ½ in.
From 7- to 30-in. belt width by 1 in.
From 30- to 56-in. belt width by 2 in.
Above 56-in. belt width by 4 in.

Pulley widths should exceed belt width by the following amounts:

Pulley Diameter, in In.	Iron Pulley, In.	Paper Pulley, In.
Under 2	¼	¼
2 to 5	½	½
5 to 10	½	¾
10 to 20	½	1
20 to 24	¾	1
24 to 36	¾	1½
Above 36	¾	2

A good handy rule to remember is: A single-ply belt 1 in. wide running at 1000 ft. per min. will deliver approximately 1 hp. (up to about 3000 r.p.m.).

Round belts of 0.25 and 0.5 in. diameter are fully equal to single belts of 1 and 3 in., respectively.

The effect of creepage and slip is to reduce the speed of the driven pulley and consequently the power transmitted. For commercial applications it will be close enough to multiply the calculated speed of the driven shaft by 98 per cent, assuming 2 per cent slip. The diameter of the driven pulley should be slightly smaller than that calculated on the basis of no slip in order to get a certain speed at the driven shaft. In other words, the speed of the driven shaft is reduced by slip unless compensated for by reducing the driven pulley diameter a proportionate amount.

A small amount of belt slip is not harmful but excessive slip is. Severe slippage burns the belt, quickly destroying its usefulness, while at best the belt surface is polished so that the grip on the pulley is materially reduced. Belt slip can be detected by noting the condition of the pulley surface. When the belt is slipping the pulley will have a very shiny appearance as contrasted with the smooth but rather dull appearance it should have.

Excessive slip is caused by poorly designed drives, where the driving pulley is too small or the load too great; by running the belt too loose; or by not giving proper attention to the care of the belt.

One of the factors affecting the amount of power that can be transmitted by a belt of given width is the arc of contact (the distance the belt wraps around the pulley). As this arc of contact decreases, the belt width must be increased to transmit the same horsepower with 2 per cent slip; Table II, however, allows a factor of safety sufficient to take care of installations which are in accordance with

TABLE I—Belt Speeds

Full Load Speed of Motor in R.P.M.	Pulley Diameter in Inches																																
	3½	4	4½	5	5½	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33
	Belt Speed in Feet per Minute																																
1750	1605	1835	2060	2290	2520	2750	3205	3670	4125	4580	5040																						
1450	1330	1520	1710	1900	2090	2275	2660	3040	3420	3800	4170	4560	4930																				
1150	1055	1205	1355	1505	1655	1810	2110	2410	2710	3010	3315	3615	3915	4220	4520	4820	5120																
860	790	900	1015	1130	1240	1350	1575	1800	2030	2255	2480	2705	2930	3160	3380	3610	3835	4060	4280	4510	4740	4960											
690	....	725	815	905	995	1085	1265	1445	1625	1810	1990	2170	2350	2530	2710	2890	3075	3250	3435	3615	3800	3980	4160	4340	4520	4700	4880	5060					
575	....	....	680	755	830	905	1055	1205	1355	1505	1655	1805	1955	2105	2260	2410	2560	2710	2860	3010	3160	3310	3460	3610	3760	3915	4060	4210	4360	4515	4665	4815	4965

the recommendations for belt ratios and center distances given in this article. If it is necessary to exceed the limits given, it may be necessary to use a belt-tightener.

In ordering pulleys specify:

1. Material.
2. Diameter
3. Belt width.
4. Bore.
5. Size of keway.
6. Maximum length of hub.
7. Hub-to-rim dimension.

The length of hub should not exceed that of the shaft extension, while the hub-to-rim dimension is determined by possible rubbing of the rim against the housing. When ordered with a motor, the motor rating, frame number, belt width, and pulley diameter are sufficient.

The life of a belt installation depends more closely on the careful selection of the belt than is generally realized. Belting is divided into two general classes: That made of leather, and that made with a cotton base. This latter class in turn can be divided into three broad divisions:

1. Solid-woven belts.
2. Canvass belts.
3. Rubber and balata belts.

There are also special belts such as camel's hair and steel belts, but their application is so limited that they will not be considered here. Oak-tanned leather belts are more common for general service, while chrome-tanned belts are particularly durable where there is a combination of high temperature and moist atmospheric conditions. For all ordinary applications only the best leather belting should be used as it is always more economical in the long run.

The various fabric and rubber belts are intended primarily to meet unusual atmospheric conditions such as steam, moisture, etc. Rubber belting disintegrates if oil soaked, hence cannot be used under these conditions. One feature is common to all fabric belts, once their normal rating is passed the tractive effort falls off quite rapidly with increased load. Another characteristic of fabric belts, including rubber belts, is that the stretch normally comes out of the belt in the first three or four days of service.

The weight of belt used for an installation is of extreme importance in determining its life. Table III shows the proper thickness of belts to be used with various pulley diameters.

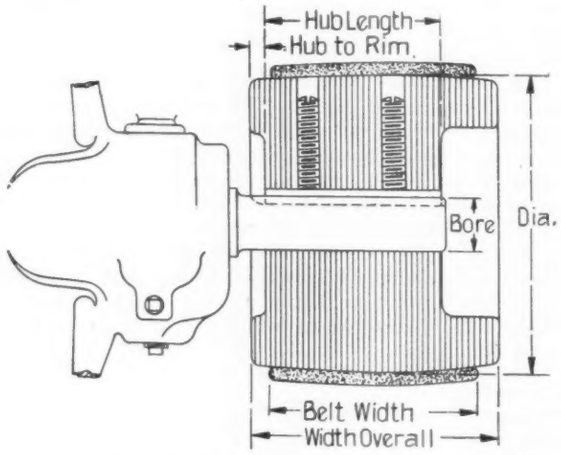


Figure 1. Principal Pulley Dimensions

The table is based upon the belt width not exceeding the diameter of pulley. If the belt to be used is wider than the diameter of the pulley it is generally possible to use a belt of the next lighter thickness than that shown in the table. In such cases it would, however, be best to ask the belting manufacturer for special recommendations.

The selection of the proper belt width to transmit a given horsepower has been discussed previously. Where a standard pulley is ordered with the motor, the belt width is specified and this belt width should be used.

TABLE III—Size of Belt in Relation to Pulley Diameter

Minimum Diameter of Pulley for Thickness of Belt in In.	Belt Thickness in In. (Leather Belting)
Any diameter under 2	Light single-ply 1/8
2	Medium single-ply 5/32
3	Regular single-ply 3/16
4	Heavy single-ply 7/32
4½	Light double-ply 1/4
7	Medium double-ply 5/32
10	Regular double-ply 5/16
18	Heavy double-ply 3/8
30	Three-ply

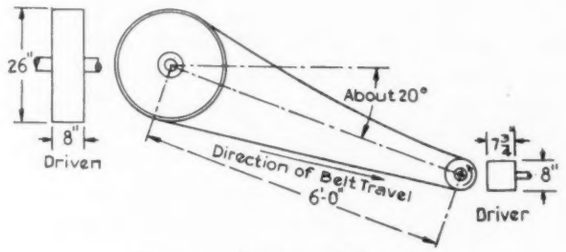


Figure 2. Sketch of Belt Layout

In determining the length of a belt, the best method is to measure the distance by a steel tape (or any tape that will not stretch) passed around the pulleys and drawn tight. If the belt is to be ordered made up to a proper length from a belting manufacturer, a sketch similar to that shown in Fig. 2 may be furnished instead, if proper measurements cannot be made.

The following rule will give approximate results with open belts:

$$\text{Belt length} = 3\,1/7\left(\frac{D+d}{2}\right) + 2 \text{ times the distance}$$

between shaft centers—where D and d are the diameters of the two pulleys. In applying this formula, the diameters and center distances must be expressed in the same units, that is, both in feet or both in inches.

In ordering a belt specify:

1. Length. Give exact length as determined by steel tape passed around pulleys. Do not include length for lap. If impossible to measure the length, a sketch similar to Fig. 2, showing center distance and pulley diameters, should be furnished.
2. Ends. State whether belt is to be shipped "endless," with square ends, or with lap allowed.
3. Width.
4. Ply. State whether regular single, light double, etc., is desired.
5. Finish. If shipped endless, state type of fastening. Cementing is to be preferred.

If the entire recommendation is to be left to the manufacturer, or if there are any unusual conditions attendant on the drive, such as bad atmospheric conditions, unusually

small pulleys, high reduction ratio, etc., a full statement of data must be given.

This should include:

1. The kind of machine to be driven.
2. Center distance.
3. Horsepower to be transmitted.
4. R.p.m. of motor.
5. Diameter and width of driving pulley.
6. Diameter and width of driven pulley.
7. Any special condition as idler, flange pulleys, step cone pulleys, automatic shipper, etc.
8. Full account of atmospheric conditions.
9. Sketch similar to one below showing layout.
10. Whether or not belt is to be made endless.
11. If belt is replacement, state kind of belt previously used, length of time it ran, apparent cause of failure, method of fastening (spliced, cemented, etc.).

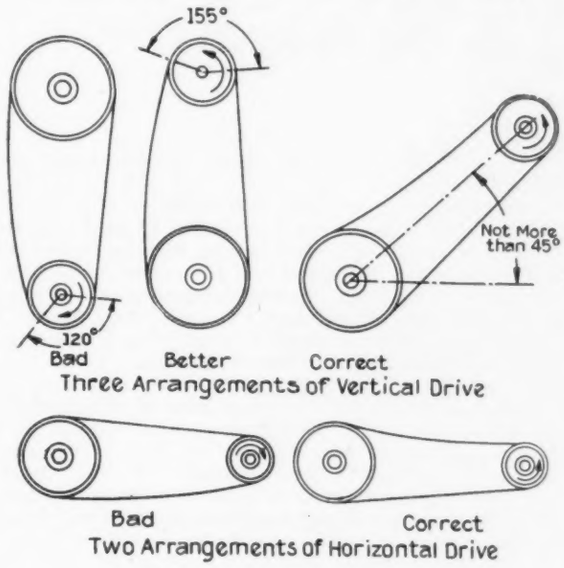


Figure 3. Arrangement of Belts

Horizontal drives are best. Under these conditions with the lower side of the belt driving, the sag of the upper side tends to increase the arc of contact. This sag should be about 1½ in. for every 10 ft. of center distance between shafts. If too loose, the belt will have an unsteady flapping motion which will injure both belt and machinery; if too tight, the bearings will be worn and the belt quickly destroyed.

Vertical and Short Center Drives

VERTICAL drives, the mounting of one pulley above another, should be avoided. This is particularly true where the lower pulley is the smaller.

The effective tension and arc of contact are reduced in vertical drives so that the normal load cannot be carried. It is better if the angle of the belt with the floor does not exceed 45 deg. Where several belts transmit power from a line shaft, it is advantageous where possible to locate the line shaft so that the bearing pressures can be equalized and reduced by alternating the direction of drive, first on one side, then on the other.

Short center distances are bad for two reasons: It means a shorter belt, so that flexure occurs at each cross section more frequently; the arc of contact on the smaller pulley frequently becomes so small that power can no longer be effectively transmitted. Two and a half times the diameter of the larger pulley should be the minimum center distance, with from three to five a better figure.

Where the space available for belt drive is limited, or where the center distance necessary to get the proper arc of contact (at least 160 deg.) is so great that the belt cost is very high, or where the ordinary means of maintaining belt tension (as by a sliding base) is impossible owing to the line of belt travel being perpendicular to the motor feet, a belt tightener should be used. A belt tightener has the advantage of maintaining an even tension at all times in the belt, and also, due to the increased arc of contact, reduces the amount of tension necessary to transmit a given horsepower.

Where a belt tightener is used, the idler pulley should be adjusted so as to give from 160 deg. arc of contact on the smaller pulley. Any effort to increase the arc of contact over 180 deg. will probably result in more harm than good, as the belt is given a reverse flexure which tends to destroy the fiber. The idler should bear on the slack side of the belt and nearer the driving pulley, but not so near as to bend the belt too sharply.

Belt tighteners for larger motors may be ordered from concerns making a specialty of their manufacture. With one form of belt tightener employing an adjustable counterweight to maintain tension, it is apparently possible to secure nearly twice the normal reduction ratio.

Methods of Connecting Belts

IN mounting pulleys, the end of the shaft should project through the pulley hub about 1/16 in. They key should be flush with the hub. The pulley should not be allowed to overhang because of increased bearing strains, while neither the shaft nor the key should project where it might catch the operator's clothing. The pulley should go on the shaft with a light driving fit. In removing, if the pulley cannot be easily pulled off, a pulley puller should be used. Hammering may damage the shaft and bearings.

In applying leather belts, the hair or smooth side of the belt should be next to the pulley. The hair side has a much better grip on the pulley, while the flesh side is stronger in tension.

A belt may be connected by flexible lacings, by rigid connections, or by cementing. This last is preferable where a sliding base may be employed for belt tightening. Fabric belts are often woven endless; leather belts are cemented. For the various types of joints the belt manufacturer should be consulted. The most important thing to remember is that the ends must be squared, and the sides of the two ends in line when united.

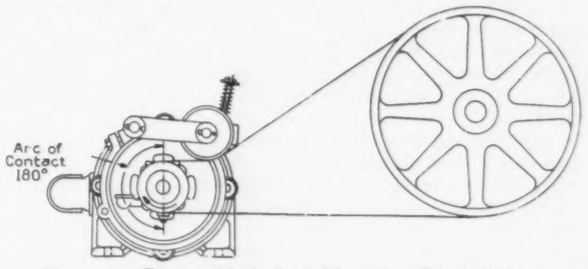


Figure 4. Proper Method of Mounting Belt Tightener

Belt dressings are used for the purpose of keeping the belt soft, or to prevent slipping. Belts are dried out by the action of the air, get hard and cracked, and require currying. Animal oils are best to apply. One common dressing is a mixture of two parts beef tallow to one of cod liver oil. The oil is added to the tallow as the latter is cooled, and stirred until cold. Neatsfoot oil is also applied. Fabric and rubber belts are usually dressed by special preparations recommended by their manufacturers. On no belt should the dressing be soaked on, but a light application made.

Powdered chalk applied after a coating of tallow will prevent slipping. Rosin, although commonly used, is particularly bad, as is also soap.

(To be continued)

NEMA Discusses

Television
Adequate Tariff
Broadcast Allocation
Terms of Payment
Nema's Position
in the Industry

TELEVISION, broadcast allocation, an adequate tariff for electrical products, terms of payment, and NEMA'S position in the industry were authoritatively presented by leading industry representatives to the members of the National Electrical Manufacturers Association at the general session on Oct. 30, held during the fall meeting of NEMA at Briarcliff Lodge, Briarcliff Manor, N. Y.

Declaring that "television is now in the same status of development with aviation in 1910 and the motor car in 1905," Louis B. F. Raycroft, vice-president of NEMA in charge of the Radio Division, emphasized the fact that the public must not be encouraged to expect television in the immediate future.

After a brief historical sketch of the radio industry's growth, and the reasons for the formation of the Federal Radio Commission and its work, Mr. Raycroft stated that "a new factor is entering the situation, threatening new complications. The public is expecting another kind of broadcasting service, popularly known as television. The Federal Radio Commission is even now considering the formulation of regulations to govern this field of endeavor.

"The great public interest in television is founded upon exaggerated newspaper reports of brilliant laboratory demonstrations rather than upon the actual practical status of this virgin field which is as yet entirely unprepared for commercial development," said Mr. Raycroft. "A diligent study of the subject leads to the inevitable conclusion that the premature stimulation of public enthusiasm in television is misleading and dangerous to the progress of radio because there is no means of satisfying the demand for reliable home television equipment. Television remains a laboratory experiment with a number of major and vital problems still unsolved. There are certain specific technical obstacles to practical television which cannot be overcome unless a fundamental and original invention or inventions are made, and no technically qualified observer will predict whether they will be made within twenty-five, ten or five years, or even less.

"The process of transmitting television images is a matter of reflecting a ray of light from the subject to a photo-electric cell and sending an electrical impression of the reflected energy point by point; this process is continued in a progressive and predetermined manner until the entire subject has been subjected to an immense number of electrical observations. An electrical impulse is radiated for each point so examined or scanned. Thousands of these 'intensity impressions' are required to send one complete image or subject. The amount of detail attainable at the receiving point is proportionate to the number of impressions to which the subject is resolved.

"In the reception of still pictures, these electrical intensity impressions are converted to light and are collected on sensitive photographic paper so that several minutes may be used to assemble a single picture consisting of hundreds of thousands of separate image impressions. In television, as in motion pictures, to give the impression of motion, however, the entire scanning of the subject must be repeated each sixteenth of a second. This rigorous requirement of television is fundamental and imposes an obstacle, at this time insuperable, to sending anything other than the crudest and simplest kind of image. The ability to send a television subject of one thousand image impressions has led the public to expect that to one hundred fold the detail is a relatively simple matter. Such an improvement would make a television reproduction of eight or ten square inches of average magazine quality, far short of the layman's conception of television. Hundred-folding the speed of any process, whether it be a man's walking pace from four to four hundred miles an hour, or an automobile's from seventy to seven thousand miles an hour, is a tremendously ambitious scientific evolution."

Mr. Raycroft continued by pointing out that, commercially speaking, television is still limited to sending crude subjects consisting of a few hundred image points. It is feasible to build more elaborate transmitters, but that would involve the utilization of enormously increased frequency bands for the transmission of the resultant signal. Stressing this point, Mr. Raycroft said: "If every broadcast station were shut down and the entire broadcast band given over to a single television service, the 1,000,000 cycle ether space thus made available could accommodate the transmission of an image two inches square, having the detail of an average magazine illustration. The equivalent of several broadcasting bands would be necessary to equal the home motion picture projector, and the cost of the experiment would stagger human imagination."

Taking a specific exampe, Mr. Raycroft assumed a transmission having the maximum detail possible in the broadcast band with a modulation frequency of 5000 cycles, and limited to the transmission of 624 image points in each sixteenth of a second. Newspaper halftones are the crudest reproductions to which we are accustomed. These have a 55 screen or 55 points per lineal inch. The best television image of that size which we can send on a 5000 cycle carrier has but one-fifth the detail of a newspaper picture, one inch square, which consists of 2965 image points. Under the circumstances the entertainment value of television is of an extremely low order and entirely unworthy of consideration from any but the experimental standpoint.

"I do not wish to imply in any sense of the word," continued Mr. Raycroft, "that television will never be accomplished or that its numerous problems are beyond the ingenuity of the American inventor. My position is merely that the methods now being employed do not offer a reasonable hope that television will ever be more than a laboratory experiment.

"Only when we learn to combine visual impressions in the same manner that sound impressions are molded into a single audio frequency, permitting us to abandon the method of sending an electrical impression successively for every point of the transmitted image each sixteenth of a second, will an entirely new phase of the situation be entered upon. In the absence of some invention which affects the conservation in carrier channels necessary to make television practical, it is an injustice to the public at large to encourage it to expect television in the immediate future."

The position of NEMA in the industry was outlined by President Huntington B.

Crouse, who stressed the need for continued and permanent effort on the part of individual members on essential problems.

"We have in NEMA a very rapidly growing association," Mr. Crouse said, "and our position in the industry will reflect the effort and time we give to NEMA'S work. We must sustain our interest in the old things that are and will continue to be of vital importance to the industry. Increased numbers and activities are giving us added strength in the industry in general. The basis of NEMA'S activities is founded in the section. The acquisition of section specialists, which has been approved by the Board of Governors, will bring us into closer touch with the sections and should be instrumental in making section efforts and programs more effective."

An interesting cross-section of the industry's practice with regard to terms of payment was presented at the general session by Harry T. Bussmann, president of the Bussmann Manufacturing Company of St. Louis. Mr. Bussmann's analysis was based on a questionnaire sent out to the entire NEMA membership of nearly 360 companies, and on which an 86 per cent return had been received.

Although the returns showed little uniformity, there was a general tendency to eliminate cash discounts. Out of 91 companies of the Apparatus Division, 49 do not allow cash discounts, 15 permit 2 per cent or more, and 33 companies charge interest on over accounts.

In the supply manufacturing field there was no tendency to eliminate the cash discount.

(The paper on "Adequate Tariff for Electrical Products," presented by Thomas Allen, is published elsewhere in this issue of ELECTRICAL MANUFACTURING.)

Electric Furnace Section Draws Members' Interest

Since the organization of the electric furnace section of the National Electrical Manufacturers Association a year ago, its membership has increased 100 per cent and it now represents over 90 per cent of the production of resistance type electric furnaces manufactured in this country. The interest of the members in the work of the section may be measured from the fact that, even with the steadily increased membership, the section has maintained an unbroken record of perfect attendance of all member companies at each of its five meetings.

The last meeting was at Mansfield, Ohio, on Sept. 12, where business sessions were held morning and evening, with golf during the afternoon. Preliminary action was taken on a standard method of rating and designating electric furnaces. Progress was made on other items of unfinished business. The representatives of the section on the joint committee with the N. E. L. A. to discuss means of developing the electric furnace business were given the views of the section regarding a number of items which are up for discussion. These included the annual electric furnace school, the use of a slogan, the publication of an industry data book for salesmen, and cooperation of the utility companies in developing the business. The committee was also instructed to present to the N. E. L. A. representatives the curve prepared by the Nema statistician, showing the aggregate kilowatt rating of resistance type electric furnaces connected to the utility lines every year since 1919 by member companies.

To Make Cable More Flexible

The Armored Cable and Flexible Metallic Conduit industry took steps Oct. 30, at a meeting of the Industry Conference with the Underwriters' Laboratories, to bring about several important improvements in its product. The new construction features, by making armored cable more flexible and therefore more easily handled, introducing firmer connections and a product less subject to injury, will be a direct benefit to both the electrical installation industry and the home owner.

This meeting of the Industry Conference was held during the sessions of the fall meeting of the National Electrical Manufacturers Association.

Power Speakers Defined

The term "Power Speaker" was held to be meaningless and without technical significance, and a resolution to that effect was adopted by the Radio Receiver Section following discussion by the Aural Devices Committee in session during the fall meeting of the National Electrical Manufacturers Association.

All loud speakers involve a certain degree of power output, and it was the opinion of those present that many purchasers were being misled with respect to the term "Power Speaker." The adopted resolution declared that "the use of the term should therefore be discouraged."

Organization of Apparatus Division

The Apparatus Division of the National Electrical Manufacturers Association is the outgrowth of an organization formerly known as the American Association of Electric Motor Manufacturers, which was composed of motor manufacturers who had been informally associated for mutual benefit, and who had acquired confidence in and good will toward one another.

As the Electric Power Club, the initial step was taken in 1916 to advance from a mere motor group to the present broad field of activity, by the organization of the Control Section. Few members of the section had ever met each other, and so it was vital to the group's progress that members become acquainted and develop confidence in each other before any important work might be undertaken.

Therefore the first efforts of the section were agreement on definitions and the establishment of a program. So spirited was the cooperation displayed between members that within a short time the confidence, which enabled the section to launch the necessary task of standardization, had been established.

During the same year the section began building up technical standards, in collaboration with the American Institute of Electrical Engineers. These standards were approved by the American Engineering Standards Committee in 1925. The Control Section thus won the distinction of being the first section in the electrical group to have its standard adopted as an American standard.

It is an interesting fact that the cooperation of the Institute was first secured by having substantially the identical committee appointed in both organizations. Later this cooperation was officially recognized and joint sponsorship was obtained from the American Engineering Standards Committee. The section fondly hopes that those standards which it first instituted as American will in the near future be adopted as international.

One of the unique features of the standards is the method of classifying resistors. This is a particularly difficult subject, and it required considerable ingenuity and concentration before the present classification table was reached.

During the World War the Control Section functioned as a committee of the whole to cooperate with the government in working out war standards for the industry. Some of these have since been embodied in permanent form as part of the standards of the National Electrical Manufacturers Association.

Several years ago control manufacturers felt the need of a clear-cut specification for use by the Underwriters' Laboratories in judging control equipment. Arrangements were made for representatives of the Control Section to assist in drawing up such specifications.

Members of the Control Section have cooperated to a great extent with members of other Nema sections, particularly the Motor Section, in their relations with outside bodies. At the present time they are interested in the rules of the National Electric Light Association for the starting of current taken by induction motors. A number of problems are arising in connection with new systems of distribution which will require close watching and probably new standards to meet changed conditions.

The Control Section has always been able to present a uniform and solid front on all opposition, and has built up an imposing standing and influence with outside organizations. H. D. James served as chairman of the section until 1924. He was succeeded by W. C. Yates, who guided the group for two years, after which T. E. Barnum served for a like term. Mr. Yates was reelected this year at the May meeting at Hot Springs.

At the request of the attachment plug section, the Standards Committee has voted to submit the section's standards to the American Engineering Standards Committee for advancement to status of American standards.

The Standards Committee has approved, subject to approval by letter ballot, the standards of the carbon section covered in Items No. 1 and No. 3 of Bulletin 218, and has referred Item No. 2 to the motor and generator section.

Electrical Equipment Can Be Exported

(*Continued from page* 212)

or a difficult one if the same care is used that is taken at home. Ample sources of knowledge are available in the various foreign chambers of commerce and organized export bodies as well as in the Department of Commerce itself, and from one or more of these agencies information from the immediate field of inquiry can be had and can be supplemented through a number of leading banks which cultivate foreign connections. From these same bodies he will learn the customs of billing and methods of collection. In the writer's experience goods were sold all over the world for twenty years on open account and without any visible percentage of losses. The nature of the business, however, was such that it did not enter into some fields where credits might not have been so sound, but if one is willing to remember that inquiries for information in distant fields require time and allow for that, there is no more difficulty in securing credit information abroad than there is at home.

There is one important matter that must not be overlooked. It is regrettably quite peculiarly an American failing. It is the vital error often made in the past of substituting for the exact goods ordered by a foreign customer something that the American shipper thinks will do, or which is the nearest to it, or of "pretty nearly" the same design. Or else it is the failing to give exact attention to what may seem to us here some petty peculiarity. Instances are known where difference in color or a label has caused the return of an entire shipment because specific instructions were ignored. The foreign customer must be treated with the same exact consideration that is given to the domestic one. It simply will not do to let the foreign buyer wait because preference is given to the man next door. If that course is to be followed, keep out of the export field, for one cannot stay in it unless it is given equal standing with the home market in the treatment of its purchases. Our British electrical engineer, whose wise counsel has been mentioned above, adds that exporters should "see that the customer gets at least as much as he has been promised," and remarks sagely that while the salesman may get the first order "the works must get the second."

The maker of electrical equipment, therefore, who desires to enter the export field, may do so fearlessly knowing that it is an arena into which his fellow-countrymen have successfully entered and which offers an expanding business to his industry. He will obtain information from the sources suggested and perhaps others open to him, and will digest it carefully. If his circumstances do not permit his entering by direct representative into the field he selects, he will be careful to learn (and he may easily learn) what house has adequate means and energy to serve him properly. He may wish to send his own representative to open dealings, or to go himself. One or the other he should do if he can. Having entered the field, after a matured decision to do so, he should treat foreign and domestic customers in a like spirit, giving to each, so far as possible, what he wishes to buy rather than what he himself may at any moment think it desirable to sell.

Applying Insulating Materials

(*Continued from page* 230)

becomes brittle and loses its mechanical strength unless well supported. Asbestos fibers can, however, be combined with bakelite varnish to make moulding mixtures that set on the application of heat and in the final state resist high temperatures, oils, acids and water.

When protecting windings against high temperatures there are different conditions that are encountered which can be briefly outlined as follows:

1—Cases where the slot area is small and the resulting copper area is worked to a high temperature on overloads. In such cases full heat resisting insulation should be used, such as asbestos insulated wire, pure asbestos tape, and the completed coil impregnated with bakelite varnish with mica wrappers used in the slots.

2—Cases where an increase in copper area and the use of asbestos insulated wire will reduce the full load operating temperature sufficiently to permit the use of cotton finishing tape with mica wrapper.

3—Cases where asbestos insulated wire, round, square or in ribbon form, can be used with mica wrapper and asbestos tape.

4—Cases where bare copper strap coils can be used, mica taped with mica wrapper and asbestos tape.

When fibre retaining wedges have been used and a high heat resisting repair job is being provided, these wedges should be left out and band grooves cut to provide for core bands as on direct current armatures. Slot wedges can, however, be made from asbestos board, transite or slate if required for mechanical support in open slots. Pure tin solder should be used in soldering the bands and for the soldering of leads into commutator necks.

In the selection of high heat resisting materials, price cannot be considered, for the reason that the best is none too good, when it is known that operating protection must be provided against extreme temperatures generated in the windings of the machine.

In the preparation of the information contained in this article, the writer acknowledges credit to the following companies: Rockbestos Products Corporation, New Haven, Conn.; York Insulated Wire Works, 120 Broadway, New York City; Mitchell Rand Mfg. Co., 19 Vesey Street, New York City; Mica Insulator Company, 200 Varick Street, New York City.

Adequate Tariff Legislation

(*Continued from page* 217)

supposed to come under this clause. It makes a vast difference whether or not an article is assessed under this paragraph or the preceding one.

This paragraph covers all articles or wares not specifically provided for, if composed wholly or in chief value of platinum, gold, silver, articles if they are plated with any of these substances, or colored with gold lacquer, either partly or wholly manufactured, 60 per cent ad valorem. If composed wholly or in chief value of iron, steel, lead, copper, brass, nickel, pewter, zinc, aluminum, or other metal but not plated with any of the above rare metals, 40 per cent ad valorem.

Paragraph 212—Porcelain. This is a long paragraph and the duties range from 55 to 70 per cent ad valorem.

Paragraph 208—Mica and manufactures thereof—40 per cent ad valorem

Ground mica—20 per cent ad valorem

Mica, cut, trimmed or mica splittings—30 per cent ad valorem.

All of these percentages are based on foreign valuation.

In order to illustrate somewhat the advisability of the manufacturers closely following the basis of assessing duties on imports and seeing to it that they are classified in the right paragraphs, I will cite only this instance—

The case is large circuit breakers. Large porcelain bushings are used in these circuit breakers, and they are each worth a great deal of money. Certain imports of these terminals were made into this country, the terminals being of chief value, porcelain, on which the duty is—if colored 70 per cent, uncolored 60 per cent, but the importers insisted a circuit breaker was a machine under the terms of the tariff act, and therefore falls under the "machine paragraph," 372, with a duty on the complete circuit breaker of 30 per cent, and any parts thereof of the same amount. Therefore they claimed that these porcelain bushings should be assessed at 30 per cent and not 70 per cent.

Now, if a circuit breaker is not a machine—and that is the contention of the manufacturers in this country—then it falls under paragraph 399, which is the "metal catchall clause," as being an article made chiefly of iron, steel, brass, etc. Then any part of the circuit breaker falls under the paragraph covering the article of chief value, and the porcelain terminal would fall under the porcelain paragraph and pay the porcelain duty when imported separately.

This is just one illustration, but there are many others which have affected the electrical industry. Therefore, each Nema section should study the paragraphs affecting its industry directly and indirectly, and advise with the tariff committee what they think should be done in a revision of the tariff to overcome such difficulties affecting their business as mentioned in this instance.

Another new feature which was incorporated in the 1922 Tariff Law is the flexible feature whereby the Tariff Commission, on the request of manufacturers or importers, will make a study of the cost of production in this country and abroad of any articles for determining whether or not the existing tariff is sufficient or insufficient to take care of the American manufacturer, and upon their findings the President of the United States can increase or decrease the rate of tariff not to exceed 50 per cent. This is an extremely valuable addition to the tariff and our importer friends, I understand, are very anxious to have it deleted in the next tariff. It is up to every American manufacturer to see that the administrative features of the existing tariff are maintained, and if possible the American valuation is extended to other clauses in the tariff as the only fair basis.

As an illustration of how this affects some of our people—In the importation of laminated phenolic condensation products, it was found that foreign manufacturers were importing them under the paper schedule, because it was claimed that the article of chief value was paper. This was found to be true in Germany, but the article of chief value in this country was not paper but was the chemical substance with which the paper was treated. Protests either have been or are to be made to the government in regard to this, because it is believed that this material should come under the material of chief content, which is in the chemical schedule and would place it on an American valuation basis. This is a matter with which one of the Nema sections is now dealing, and the tariff committee is helping them to sustain their position so far as it can.

Prior to the Tariff Act of 1922, our tariff committee endeavored to bring this whole situation before our industry and get them interested in making a study of the conditions to be met; but as there was an apathy on the part of the manufacturers, the tariff committee worked under a great handicap. The tariff law was passed and then, when certain of our electrical manufacturers began to find imports coming in, they complained bitterly and wanted it changed. This is true of some of the machinery manufacturers; the radio manufacturers; the laminated phenolic products manufacturers; molded and manufactured mica, and a number of others.

Function of the Wholesaler

(*Continued from page* 247)

through the strictly electrical supply wholesaler, and it hopes to eliminate some of the evils that now act to defeat this purpose. Regarding this point, G. P. Rodgers, Managing Director of the association, says:

"The selling and distribution of electrical goods is no longer carried on by one class of dealer. Electrical appliances for the home are sold by light and power companies, department stores, general stores, dry-goods stores, hardware stores, electrical dealers, contractor dealers, house-furnishing stores, drug stores, and many others. Other types of electrical products, such as those going into large buildings, industrial plants, railroads, central stations and other large institutions, are being sold sometimes direct by the manufacturer, sometimes through the wholesaler, and frequently through other channels.

"Under such conditions we find the strictly electrical supply wholesaler faced with many problems, the keenest kind of competition, and many trade evils."

The amount of work to be done in eliminating the chaotic conditions of marketing in the lighting field can best be estimated from the conditions actually existing in this field. To determine these conditions, a questionnaire was sent to thirty manufacturers, twenty-four of whom replied, as shown in Table 1 on page 247. One manufacturer was undecided.

4. The success of any wholesaling plan depends largely on the spirit of cooperation in which it is carried on

EVIDENTLY the success of any distribution system will depend upon the cooperation of the manufacturing and marketing elements. It cannot be said that distributing any class of goods through wholesalers is either successful or not successful, because success or failure depends almost entirely on the method and spirit of application.

"While there are many changes in business methods, the real principles of life and business never change. They are founded on good will and service, and all great things come as a result of cooperation and coordination."

Electrical Manufacturing News

A department containing news and descriptions of new materials, parts, devices and special tools for the manufacture and repair of electrical products

A. Penn Denton Closes Firm to Head Nema Section

A. Penn Denton, president of the Denton Engineering and Construction Company, Kansas City, Mo., has closed out his electrical contracting and machinery business and joined the National Electrical Manufacturers Association in the capacity of engineering director of the Armored Conductor and Metallic Flexible Conduit Section. He assumed his new duties Nov. 1.

A. Penn Denton

Mr. Denton, one of the foremost electrical contractors in the Middle West, graduated from Cornell University with a degree of E. E. in 1904. He spent four years with the General Electric Company in Schenectady, N. Y., in both commercial and engineering work, and entered business in Kansas City in 1908. He has engaged in a general engineering, electrical construction and machinery repair business for the past 21 years, during which time his organization installed every type of electrical installation in all kinds of buildings.

In his new connection Mr. Denton's work will be directly for and supported by the Armored Conductor and Metallic Flexible Conduit Section of Nema. His activities will be carried on along broad lines so as to induce armored conductor manufacturers to support the National Electrical Code. According to Mr. Denton, armored conductor manufacturers, to sell the greatest amount of material possible, must have due regard for manufacturers of other types of wiring and be willing to cooperate with all manufacturers of wiring devices and materials, to the end that all manufacturers and the entire electrical industry may benefit alike.

W. W. Freeman Elected President of S. E. D.

Work accomplished under the program of The Society for Electrical Development since the first of the year was unanimously approved by its board of directors in annual meeting on Oct. 23, when special emphasis was given by representatives of national associations to the fact that the S. E. D. is fulfilling in a practical way its mission both as a workshop and as an all-industry forum.

With respect to furthering the purpose of the directorate as a forum and clearing house for common problems, it was agreed unanimously that hereafter quarterly meetings of the board should be divided into two sessions in order that adequate attention may be given to reviewing and acting upon problems which affect all with equal force.

Among the activities which were reviewed by the directors as indicative that the Society had firmly established its niche in the electrical family were steps taken thus far by Industry Sales Conference in its study to develop a national selling program; progress with such concerted programs as the Franklin Plan for industrial and commercial lighting; extension of services in connection with the uniform ordinance activity; participation in and preparation of range and refrigeration programs in cooperation with the national associations; enlargement of field work among local electrical leagues and a general attitude of inter-association and inter-company helpfulness in various departments of promotional activities.

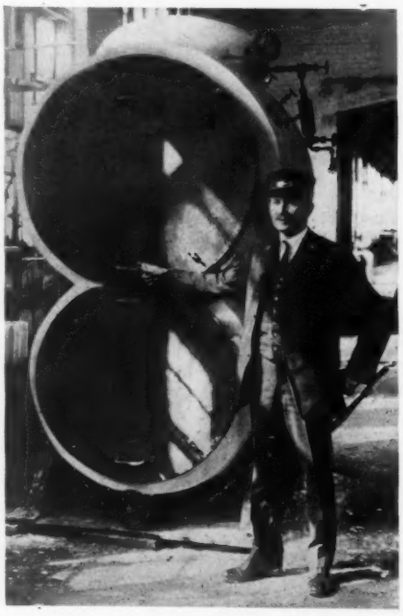
W. W. Freeman, vice-president of the Columbia Gas & Electric Company, and chairman of the Union Gas & Electric Company of Cincinnati, was reelected president of The Society for Electrical Development at the annual meeting of its board of directors on Oct. 23, and the following were elected ranking vice-presidents in the order named:

C. L. Chamblin, president of the Association of Electragists, Int., and president of the California Electrical Construction Company; H. B. Crouse, president of the National Electrical Manufacturers Association and president of the Crouse-Hinds Company of Syracuse; R. Bourke Corcoran, manager of the Electric Association, Chicago, and chairman of the Electrical League Council; George E. Cullinan, chairman of the executive committee of the National Electrical Wholesalers Association and vice-president of the Graybar Electric Company, and P. S. Arkwright, president of the National Electric Light Association and president of the Georgia Power Company.

C. L. Edgar, president of the Edison Electric Illuminating Company of Boston, was reelected chairman of the executive committee, and S. L. Nicholson, vice-president of the Westinghouse Electric & Manufacturing Company, vice-chairman.

R. Bourke Corcoran, incoming chairman of the League Council as vice-president, replaced J. E. North of the Cleveland Electrical League and former chairman of the League Council, who continues as a director.

An Ingenious Fare-Taker



Above is W. E. Hudson, veteran conductor on the Long Island Railroad, N. Y., who has invented an electric steam boiler for heating trains

Commerce Department Reviews Radio Industry Conditions

A survey of wages and hours of labor in the radio manufacturing industry in the United States was recently completed by the Bureau of Labor Statistics of the Department of Labor. Agents of the Bureau visited radio establishments in Illinois, New York, Massachusetts, New Jersey, Michigan, Pennsylvania, Rhode Island and Ohio.

In the course of the review 23 schedules representing the manufacture of radio receiving sets, 19 representing the manufacture of loud speakers, and 18 representing the manufacture of radio tubes, were obtained. It was found that the average pay in the various departments of manufacture ranged from $20.36 for radio tube workers to $23.25 for receiving set workers, per week. It was set forth that workers in the radio industry average less than five and one-half days a week, and that the industry is idle for several months each year.

Paper Insulation Research Attracts Attention

According to the committee on electrical insulation of the National Research Council, research in the field of impregnated paper insulation is being actively followed in a number of industrial and university laboratories. The committee has arranged a conference on the subject, which will be held at the School of Engineering, John

Hopkins University, Baltimore, Md., Nov. 16 and 17. The program calls for a review of what has been accomplished in the paper insulation field and a discussion for furthering the work already under way. A number of prominent technicians have signified willingness to attend.

Revised Standards Approved by RMA Directors

The new edition of "Radio Industry Standards," designed to assist in the stabilization of radio, has been approved by the board of directors of the Radio Manufacturers Association. The revision was prepared by the RMA engineering division, H. B. Richmond, Cambridge, Mass., director. The new standards adopt the definitions and tests as promulgated by the Institute of Radio Engineers, with the exception of those regarding television, which were considered by the special television of the RMA. The manual may be obtained from the RMA office, 32 W. Randolph St., Chicago.

H. B. Richmond

The revised manual for the first time in radio history includes recommendations for the orderly development of television. The standards dealing with television terminology were framed for the purpose of assisting engineers and the trade press in a proper understanding and usage of new terms incident to the progress of television experiments. They were evolved by a committee headed by D. E. Replogle, Cambridge, Mass., meeting in Chicago Oct. 9.

Copper and Brass Association Elects Agassiz Head

R. L. Agassiz, chairman of the board of directors of the Calumet and Hecla Consolidated Copper Company, was reelected president of the Copper and Brass Research Association at the eighth annual meeting, held at the association offices, 25 Broad St., New York City.

The following were elected to the executive committee of the board of directors: R. L. Agassiz, Walter Douglas, Thomas D'A. Brophy, Stephen Birch, Charles Hayden, Edward H. Binns and Barton Haselton.

Franklin Institute Plans Nearing Completion

Plans for the new Franklin Institute, which will be erected on the Parkway, Philadelphia, are progressing, under the leadership of Dr. Howard McClenahan, secretary of the institute. The construction and endowment will cost $7,000,000 and the structure will contain museums, covering all phases of science. There will be such pioneer electrical devices as the Benjamin Franklin electrical apparatus and the first Brush arc-light dynamo.

Manufacturers to Study New Radio Legislation

At a meeting in Chicago the board of directors of the Radio Manufacturers Association ordered its legislative committee to make a thorough study of the new radio broadcast set-up, which goes into effect Nov. 11. In addition, the board advised the committee to undertake a survey of radio legislation and recommend amendments to the radio law if the new allocation revealed their necessity.

The officers of the RMA have been informed by Congressional leaders that because of the brevity of the coming session of Congress, it is improbable that legislation will be effected next winter. Any new radio enactments which may be recommended would likely come in the Congress of the next administration and after the effects of the reallocation have been studied.

Electric Industry Making Progress in Europe

Great strides have been made in the electrification of industry in Europe in recent years, the total output of electrical energy at present amounting to about four times the 1913 total. In utilization of water power and electrification of railways, Italy leads, with France closely behind.

Much of the progress since 1913 has been made with the assistance of American capital. Germany, for example, has borrowed $210,000,000 here for the development of her natural and mechanical power industries, while Italy has obtained $115,000,000 for the same purpose.

De Forest Wins Victory in Feed-Back Suit

In a decision handed down by the Supreme Court of the United States, Dr. Lee De Forest and his associates were awarded a verdict over Edwin H. Armstrong and the Westinghouse interests. The issue concerned the priority of invention of the feed-back circuit, through which the modern radio receiver, by amplification of radio signals, has been made effective.

The Supreme Court, in awarding the decision, upheld the judgment of a lower court. According to C. A. Perry, vice-president, Westnghouse Electric and Manufacturing Company, the decision cannot interfere with his company's right to manufacture since Westinghouse is licensed under the De Forest patent.

Prize for Product Name Offered by Nema

In an attempt to coin a word which will become identified with all molded products, the molded insulation section of the National Electrical Manufacturers Association announces that a prize of $250 will be awarded to the person submitting the most suitable suggestion.

The definition of the material to which the name will apply is: "Any substance composed wholly or in part of an artificial gum capable of setting into a hard non-softening body." Radio panels and knobs, telephone receivers, heater plugs and pipe stems are well-known examples of products which are molded.

Each contestant may submit only one name, which must be written on a card and mailed, addressed to the "Nema Name Contest," National Electrical Manufacturers Association, 420 Lexington Ave., New York City, before midnight, Jan. 15, 1929. The name should not be based on the names of the ingredients now in use, since these may change as the art develops. It may or may not be descriptive of the properties or use of the material.

Westinghouse Appoints New Engineering Manager

H. H. Ashinger has been appointed assistant to general manager for the South Bend, Ind., works of the Westinghouse Electric and Manufacturing Company. He graduated from Purdue University in 1913 with the degree of Bachelor of Science in Electrical Engineering. He served as an instructor in mechanics at Ohio State University for a half year.

Mr. Ashinger was associated with the Easterline Company, Indianapolis, Ind., before joining the George Cutter Company, which was subsequently taken over by Westinghouse. He was instrumental in the design of a number of lighting fixtures and accessories now being sold.

Atwater Kent Receiver Ready for Presidential Winner

The two millionth Atwater Kent radio set, destined to go to the winner of the presidential election, was turned out by the Atwater Kent Manufacturing Company in Philadelphia, on Oct. 24. The chosen set was singled out from more than 8,000 similar sets turned out the same day, given final adjustments and tests by Mr. Kent personally, and then placed in his office to be held until the counting of the ballots determines its owner. The set is the model 40, operating direct from house current, with one dial and single volume control.

The picture shows Mr. Kent testing the two millionth Atwater Kent receiver, which will be presented to the newly-elected President of the United States

Radio Corporation of America Appeals on Receiving Sets

As owner of the patents which it asserts are used in almost all receiving sets on the market, the Radio Corporation of America has requested the United States Supreme Court to determine whether it can require manufacturers to purchase tubes made by the Radio Corporation. Similar requests by the R. C. A. have been turned down by lower courts.

The corporation declared that it was in a position to put out of business many of its competitors by refusing to permit them to use its patents. It decided, however, not to do that, but to license competitors, reserving in the contracts a stipulation to the effect that competitors should buy the tubes used in making their sets from the Radio Corporation of America.

The lower courts ruled that these agreements could not be enforced, since they were a violation of the Clayton anti-trust act.

Graduate Students Enroll for Westinghouse Course

Educational representatives of the Westinghouse Electric and Manufacturing Company interviewed 3,500 college seniors this year, of which 1,900 applied for the graduate student course. Of this number 260 men were accepted.

Along with the graduate student course the company offers other training courses. Forty college graduates were employed by the company as testers and 25 students were permitted to enroll in the junior graduate course, which is conducted during the summer months. In the 2-year intermediate course, open to high school students, 33 men took part.

In order that all offices of the Westinghouse organization may have men who are familiar with the methods of the company, 13 foreign students, representing 12 colleges in 9 countries were afforded an opportunity to familiarize themselves with American manufacturing methods. Australia, the country farthest away, was represented by four students, the most from any one nation.

General Electric Sales Show Substantial Gain

Sales billed for the first nine months of 1928 amounted to an increase of $16,717,152 over the same period in 1927, according to a statement by Gerard Swope, president of the General Electric Company. The profit available for dividend on common stock is equivalent to $5.12 per share in 1928, as compared with $4.61 per share a year ago.

New Yorker Wins Acclaim at Belgium Exposition

At the recent International Exposition at Liege, Belgium, John B. Salterini, New York, was one the exhibitors in the gathering which included representation from 32 nations. He was awarded the *Grand Prix* and *Medaille d'or* for his presentation of wrought iron originations.

High Voltage in Action

A night view of a sustained 750,000 volt flashover in the laboratory of the Delta-Star Electric Company, Chicago, Ill.

Youngstown Sheet and Tube Buys Electric Equipment

The Youngstown Sheet and Tube Company, Youngstown, Ohio, has placed a quarter-million dollar order for electrical equipment for a 44-inch electrically driven reversing blooming mill, with the Westinghouse Electric and Manufacturing Company. The new outfit, which will replace an existing steam engine drive that has been in operation for fourteen years, will be installed in the Campbell works in about five months.

The mill will be driven by a 7000 hp. single unit direct current reversing motor, operated at 50-120 r.p.m. Power for the motor will be supplied by a flywheel motor generator set consisting of two 3000 kilowatt 700 volt generators operating at 360 r.p.m., one 5000 hp. 6600 volt, three-phase, 60 cycle AC motor, and a 140,000 pound steel plate flywheel.

Scientists Produce Highest Voltage Ever Obtained

Scientists of the Department of Terrestrial Magnetism of Carnegie Institution, Washington, D. C., have succeeded in producing at the Washington laboratory a higher electrical voltage than man has hitherto ever obtained. With relatively inexpensive apparatus, compact enough to be easily contained in a small-sized room, they have developed an electrical pressure of more than 5,200,000 volts.

Dr. G. Breit and Dr. M. A. Tuve, who have been working on the problem for several years are confident that, when the need arises, even greater voltages can be obtained by the method they have developed.

Westinghouse Report Shows Promise of Record Year

Earnings of the Westinghouse Electric and Manufacturing Company are running at record levels, and it is probable that returns for the first nine months of 1928 will almost equal the net income for the full fiscal year ended March 31 last, when the net income amounted to $15,639,172, or $6.59 a share. Since the publication of quarterly earnings early in 1927, the best showing in any three months was for the period ended Sept. 30 last, when net income represented an increase of 66 per cent over the previous quarter and 70 per cent over the corresponding quarter of 1927.

Western Electric Will Build Factory in Baltimore

The Western Electric Company has acquired 125 acres of land in Baltimore upon which to erect a $15,000,000 plant for the manufacture of telephone wire and cable, it has been announced by Edgar S. Bloom, president.

The first buildings will be equipped to produce 110,000,000 feet of cable a week. Development of the property will be begun soon, and it is expected that the first building will be completed by the end of 1929.

Lowell S. Monroe Joins Copperweld Steel Co.

The Copperweld Steel Company, Glassport, Pa., has announced that Lowell S. Monroe, former advertising manager of the Electric Controller and Manufacturing Company, Cleveland, Ohio, is now a member of the Copperweld engineering staff, in charge of service data.

Mr. Monroe is a graduate of the University of Michigan and later took postgraduate work at Ohio State University. He was associated with General Motors Corporation for several years.

Ohio Brass Co. Announces Retirement of E. C. Brown

E. C. Brown, who has been identified with the public utility industry for many years and with the Ohio Brass Company, Mansfield, Ohio, for twenty-one years, has retired from active duty and removed to California. He was on the sales force of the company in the Mississippi Valley until two years ago, when he took over supervision of the Southwest district. He held that position until his retirement.

Burke Electric Company Appoints New Officers

At a meeting of the directors of the Burke Electric Company, Erie, Pa., manufacturer of motors, generators and welding equipment, James Burke was chosen

chairman of the board of directors, to fill the office left vacant by the death of Isadore Hernsheim, New York City, last August. The following officers were named by the directors:

George H. Winkler, president; R. W. DeLancey, vice-president; G. Irving Blake, treasurer; C. J. Gibson, assistant treasurer, and Charles H. Schum, secretary.

General Electric Plant Head Dies in Schenectady

James A. Smith, superintendent of the Schenectady plant of the General Electric Company for the last 15 years, died at his home in Schenectady, Oct. 25, the victim of a stroke suffered the night before.

James A. Smith

He was born in Hartford, Conn., in 1873 and spent his early days on a farm. In 1888 he joined Pratt & Whitney, Hartford, Conn., later entering the apprentice shop of that company. He installed the company's exhibits both at the World's Fair in Chicago, in 1893, and in the Paris Exposition of 1900. He was associated with the Dutchess Tool Works, Fishkill Landing, N. Y., before joining the forces of the General Electric Company in 1910.

York Ice Machinery Corp. Merges with U. S. Freezer

The York Ice Machinery Corporation, York, Pa., and the U. S. Freezer and Machine Corporation, Brooklyn, N. Y., have announced a consolidation to be known as the Dairy Equipment Division of the York Ice Machinery Corporation.

The products and personnel of the York Milk Machinery Corporation, a subsidiary of the York Ice Machinery Corporation, have been combined with those of the U. S. Freezer and Machine Corporation to manufacture a complete line of equipment for dairies, ice cream manufacturers and creameries.

Brevities

Technical Products Company, 114 S. Sheridan Ave., Pittsburgh, Pa., recently issued a manufacturers' manual of industrial cement for all purposes. In it are listed the best materials and simplified methods for assembling, insulating, cementing, sealing, fire-proofing, heat treating, porcelainizing and many other processes.

Despatch Oven Company, 116-122 First Ave., N., Minneapolis, Minn., announces plans for the building of a new factory for the manufacture of ovens for all purposes. The enlargement of manufacturing facilities has been made necessary as a result of a large increase of business this year over last year.

Electric Tachometer Corporation has moved from 310 N. Eleventh St., to Broad and Spring Garden Sts., Philadelphia, Pa.

Saturn Manufacturing & Sales Company, New York City, has turned over its entire production to the Union Insulating Company, Parkersburg, W. Va., according to a statement by A. J. Volk, vice-president of the Saturn Company.

Continental Steel Products Company, Youngstown, Ohio, is the new name for the Morgan & Wayman Manufacturing Company.

Service Sales & Manufacturing Company has changed its address from 3429 W. 126 St., to 17005 Melgrave Ave., Cleveland, Ohio.

American Gear Manufacturers Association held its annual convention at the Statler Hotel, Buffalo, N. Y., Oct. 10 and 11.

Amy, Aceves & King, Inc., is the name of a new radio engineering firm established at 55 W. 42nd St., New York City. The firm intends to serve the needs of radio manufacturers and broadcasters in a consulting capacity, for which purpose a complete testing and research laboratory has been established at 91 Seventh Ave,, New York City.

Personals

Burton Greene, vice-president and general manager, Electrical Research Laboratories, Chicago, has succeeded George A. Parson as president of the company. Mr. Greene was formerly head of the Greene-Brown Manufacturing Company, which was recently merged with Electrical Research Laboratories.

Harold C. Osman, secretary, Nugent Steel Castings Company, Chicago, and heretofore in charge of sales for the company, has been appointed works manager.

Adam E. Daum, vice-president and treasurer, Impervious Varnish Company, 421 Wood St., Pittsburgh, was elected a director of the National Paint, Oil and Varnish Association, Inc., for a three year term, at the annual convention held in Detroit, Oct. 15-19.

Carl D. Boyd has been elected president of the Slagle Manufacturing Company, to succeed L. S. Slagle, retiring president. An increased schedule of production is being instituted immediately.

Anthony J. Kaiser, formerly with Cutler-Hammer Manufacturing Company, has established an independent consulting organization, known as the Kaiser Engineering Company, 155-31 Jamaica Ave., Jamaica, N. Y.

Coming Conventions

American Institute of Consulting Engineers.—Annual meeting at New York City, Jan. 14, 1929.

American Institute of Electrical Engineers.—Annual winter convention at New York City, Jan. 28-Feb. 1, 1929.

American Society of Refrigerating Engineers.—Meeting at New York City, Dec. 3-5.

Midwest Power Conference and Exhibition.—Chicago, Ill., Feb. 12-16, 1929.

National Association of Practical Refrigerating Engineers.—Meeting at Louisville, Ky., Nov. 20-23.

National Electrical Credit Association.—Annual meeting of central division at Chicago, Nov. 15-16.

New York Electrical Credit Association.—Annual meeting at New York City, Dec. 11.

New York Power Show.—Grand Central Palace, New York, N. Y., Dec. 3-8.

Society for Electrical Development.—Mid-winter conference at Cleveland, Ohio, Jan. 7-9, 1929.

Manufacturers' Catalogs

Federal Bearings Company, Inc., Poughkeepsie, N. Y. Catalog, radial ball bearings, extra small series.

Schatz Manufacturing Company, Poughkeepsie, N. Y. Catalog No. 10, annular ball bearing rollers.

Crouse-Hinds Company, Syracuse, N. Y. Bulletin No. 2114. Obround condulet.

James G. Biddle, 1211 Arch St., Philadelphia, Pa. Bulletins No. 1180 and 1190, "Megger" ground resistance tester.

Information Wanted

We have been asked for the names and addresses of manufacturers of the articles listed herewith.

Replies from our readers to any of these inquiries will be greatly appreciated by the Information Bureau of ELECTRICAL MANUFACTURING, 461 Eighth Ave., New York City.

"L. R. Co." Receptacles.
"Splendida" Electric Iron.
"Sal Co. 176" Lamps.
"Electron" Heating Pad.
"Lilly Wilson" Vacuum Cleaner.
"Perkins" Siren.
"Wharton" Battery Charger.
"Flint" Waffle Iron.
"Packard" Vacuum Cleaner.
"Blaisdell" Automatic Electric Cigar Lighter.
"Columbus-Universal" Electric Vacuum Cleaner and Floor Polisher.
Address of Dura Electric Appliances (Manufacturers of Curling Irons).
Address of Buckeye Instrument Co. (Manufacturers of Instruments).

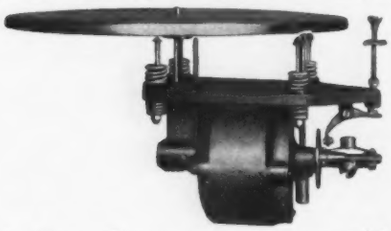
New Goods for Your Inspection

Automatic Timer

Walser Automatic Timer Co., 285 Madison Ave., New York, offers to the market an automatic timer for timing vulcanizing, permanent hair waving, electric therapy, motors of all kinds, blue printing, baking ovens, photographing, magnetic clutches, water heaters, etc. This device operates a 20 amp. two-pole switch on either a 110 or 220 volt circuit. The timing range is 30 min. The clock never requires winding and does not run when the hand is at rest. The hand can be set for any time period from 1 to 30 min. When the clock has run for the period for which it has been set it will open the circuit, but runs 2 extra minutes for safety. After the hand has been set, it can be reset to change the length of run by turning it back or forward to any time desired or it can be turned back to zero to open the circuit.

Phonograph Motor

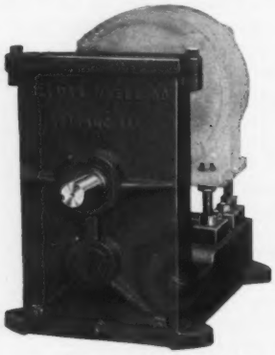
Signal Elec. Mfg. Co., Menominee, Mich., announces a phonograph motor of the induction type. Having no brushes, it



is silent. Reserve power assures quick pick-up and constant speed while under load. It is equipped with speed control, automatic stop and turntable. Height under the mounting board is 3¾ in.

Speed Reducer

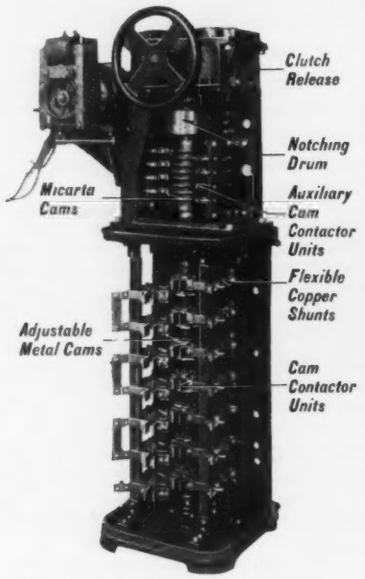
Cullman Wheel Co., 1346 Altgeld St., Chicago, is now marketing a speed reducer



which steps down the high speed of electric motors to that required for machines or for special purposes. It is furnished in single reduction type in 4 sizes, ranging from ¼ to 5 horsepower, and in double reduction type in 3 sizes, ranging from ½ to 5 horsepower. The low speeds obtainable by single reduction range from 46 r.p.m. to 332 r.p.m., and by double reduction from 2.5 r.p.m. to 90 r.p.m. All working parts operate in an oil bath. Gears and sprockets are made of hardened steel. Diamond standard roller chain connects sprockets. All ball bearings are phosphor bronze. Shafts, which run in oil, are made of steel, hardened and ground. The motor is mounted on 4 adjustable studs, which allow for the adjustment of the chain. Bearings are provided with a drain, which returns the oil to the oil reservoir. The speed reducer and the motor are built in one unit.

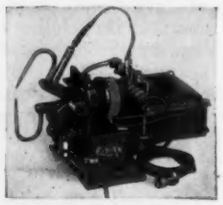
Motor Operated Cam Controller

Westinghouse Elec. & Mfg. Co., East Pittsburgh, Pa., announces the manufacture of Class 13-300 motor operated cam controller, designed for secondary control of wound rotor induction motors carrying 250, 500, or 800 rotor amps., at 1000 secondary volts. These controllers, which are made with either 13 or 23 contact points, have been especially designed to vary the



speed of such equipment as wound rotor motors operating forced or induced draft fans or remotely controlled pumps or compressors. Speed is regulated by varying the resistance in the secondary circuit. They may be manually or remotely operated and are especially adapted to service requiring a wide range of speed regulation. Complete controller consists of three units: the main, top and auxiliary units. The main unit consists of a group of cam operated contactors which carry the motor secondary current. The top unit includes a pilot motor with brakes, a notching drum, hand wheel, clutch and eight contactor units. Either a compound wound, DC pilot motor or AC three-phase pilot motor is furnished. The current is operated from one extreme position to the other in 16 seconds.

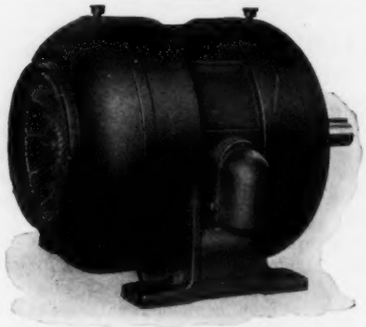
Welding Machine



Eisler Engineering Co., Inc., 756 S. 13th St., Newark, N. J., offers to the market a new welding machine designed especially for rapid, fine welding. It is used in the manufacture of radio tubes, jewelry, metal novelties, sheet metal work and wire welding. It may be used for welding wires as fine as .0005 in. to ⅛ in. The machine operates on either 110 or 220 volts, 60 cycles. The welding heat is varied by a rheostat connected to the primary of the transformer. The machine operates as follows: A foot treadle is directly connected to the machine by means of a chain. When pressure is applied, the upper electrode moves down and makes contact, holding the necessary pieces to be welded firmly in place. Increased pressure causes the breaker points to make contact and the current to flow. On releasing the foot treadle, the upper electrode will return to its original position, the entire operation taking but a few seconds. Various types of electrodes are employed. The machine with a ½ kv-a. transformer weighs 37 lb. and occupies approximately 150 sq. in. of table space.

Totally Enclosed Motors

Allis-Chalmers Mfg. Co., Milwaukee, Wis., announces a new line of totally enclosed fan-cooled motors, ranging in horse-



power from 1 to 50. All active parts of these motors are completely enclosed, preventing contact of outside air, dirt, dust, fumes, moisture, etc., with the interior or active parts. Heat is carried away by forced air ventilation, controlled by a circumferential air jacket. Solid cast iron bearing housings are attached to stator end heads with machined fit, which, with grease packed bearings, forms a tight end enclosure. Internal parts of the motor are readily accessible by removal of housings. In many ratings this totally enclosed design delivers the same horsepower output as is obtained from the same frame in the standard open rating. Temperature rise is designed to be within 55 deg. C.

For new commutator surfacing machines, coil winding machines and tools, dipping and impregnating equipment and other tools see the Encyclopedia of Tools and Equipment for Manufacturing and Repairing—Part 1 beginning on the following page.

Encyclopedia of Tools and Equipment for Manufacturing and Repairing—Part 1

This comprehensive pictorial Encyclopedia of Tools and Equipment for Manufacturing and Repairing is the first to be compiled and gives the latest available information, specifications, illustrations and list prices for all types of armature and coil making and repairing devices and other special machines and tools used in the manufacture and repairing of motors and generators and transformers. This material is published in two sections as follows:

Part I—in this issue:

Undercutting machines, commutator surfacing machines and tools, coil winding machines, blowers, sprayers, ovens, dipping tanks, impregnating equipment, jacks, hoists and lifts, pulley gear and pinion pullers and other equipment.

Part II—to be published in the next issue:

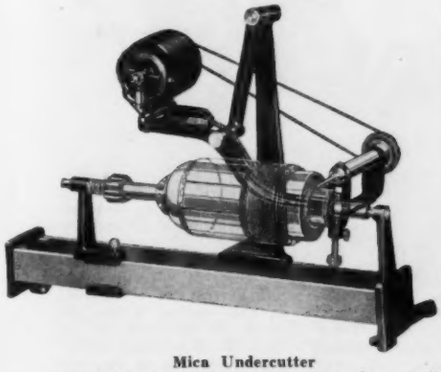
Armature growlers, test stands, test benches, meters, trouble shooters, fault finders, tachometers, insulation testers, etc.

Wherever possible an illustration is included for each type of device listed and every effort has been made to secure the character of information most useful to the manufacturer and rebuilder.

A complete up-to-date and revised list of all manufacturers appears in the Classified Index of Raw Materials, Parts and Electrical Equipment which is a regular monthly feature of ELECTRICAL MANUFACTURING.

Allen Electric & Equipment Corp.

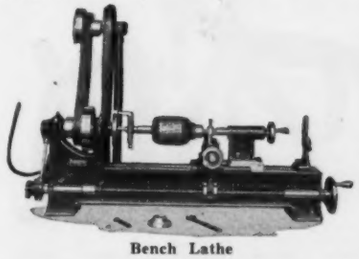
Kalamazoo, Mich.



Mica Undercutter

Trade Name—"Allen"; **Description**—For small armatures; has 20 disc cutters, .015 in., .020 in., .025 in., .030 in. and .035 in. thickness (4 each); has universal motor; **Weight**—30 lbs. (shipping); **List Price**—$48.00.

Trade Name—"Allen"; **Dimensions**—10 x 24 in. long; **Weight**—230 lbs. (shipping); **List Price**—$110.00 ($20.00 additional for driving motor and pulley; $50.00 additional for 4 in. 3 jaw chuck, 1 tool holder, lathe dog, center rest and 2 tool bits).



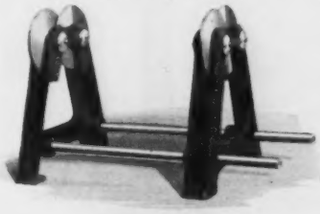
Bench Lathe

Puller Press

Trade Name—"Allen"; **Use**—Removes small armature bearings, gears, couplings, slip rings, clutches and commutators; **Dimensions**—(Height) 4½ in. max. range; (base) 4½ in. dia.; travel of screw, 5 in.; **Weight**—25 lbs. (shipping); **List Price**—$22.50, including puller plate.

Anderson Bros. Mfg. Co.

Rockford, Ill.

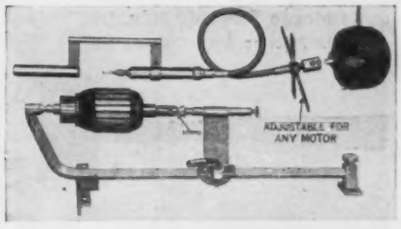


Armature Balancer

Trade Name—"Anderson"; **Use**—For straightening armatures and shafts; **Dimensions**—(Swing) 20, 40, 60, 72, 96 in.; **Weight**—45, 80, 150, 350 and 650 lbs. (shipping); **List Price**—Not stated.

J. J. Ankenbrandt

2140 Wakeman, Toledo, Ohio



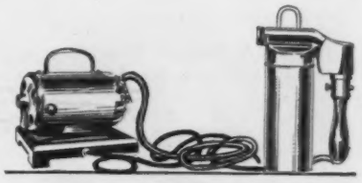
Mica Undercutter

Trade Name—"Ideal"; **Description**—Portable with a flexible shaft 18 and 20 in. long with a collet chuck taking ⅛ in. burrs; will fit shafts ⅜, 7/16 and ½ in.; has adjustable stand, swinging 7 in. and 20 in. between centers; **List Price**—Not stated; **Special Features**—Will cut the mica equally well where the commutator is on a slant; can be raised up out of the way when not in use; the stand may be used for winding armatures, putting on binding string, soldering commutators, straightening shafts, etc.

Atomister Corp.,

Rahway, N. J.

Trade Name—"Atomister"; **Use**—For paint spraying motors, etc.; sprays paint, lacquer, varnish enamel, bronze, wall finishes, shellac, white wash, stencil ink, oils, powders, insecticides, exterminators, disinfectants, etc.; **Description**—Portable spray gun has a quart fluid



Catalog B

container and its spray density is controlled by a trigger switch on the handle. The compressor unit is attached to this spray gun by an air hose and can be placed on the floor when in operation. It is equipped with an universal screened motor, A.C. or D.C. current, 110 volts, standard (special for 32-220-250 if desired at $2.50 extra), and has an air pressure of 24 to 30 lbs.; **Weight**—Spray gun and container, 1 lb.; compressor, 5 lbs.; **List Price**—$39.50 complete, includes 12½ ft. of air hose and 12½ ft. of electric cord.

N. P. Bowsher Co.,

924 S. Webster Ave., South Bend, Ind.

Balancing Way No. 1

Trade Name—"Bowsher"; **Use**—The way is used in balancing all kinds of work, such as cutter-heads, pulleys, crank shafts, armatures, etc.; **Description**—This tool consists of a frame or bed, with two planed ways, on which are mounted two standards. One of these standards is fixed, and the other is movable, the same as the tail-block of a lathe. The top edges of the standards are chilled and ground true and form the "ways" on which the work is rested while being tested for "balance." The frame is intended for bench mounting and is used for light work. A spirit level is secured to the fixed standard, and also one to the frame, so that both lateral and cross levels can be accurately determined. When leveled up the standards can be instantly moved on the bed to accommodate any length of arbor; **Dimensions**—21 in. long, 9½ in. high (standards); **Weight**—75 lbs.; **List Price**—$50.00.

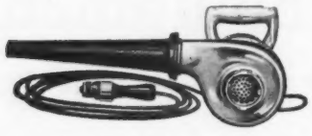
Balancing Way No. 2, adopted for general shop use and medium sized work. The frame is supported by three legs. One leg is fixed and is a little longer than the other two, which are adjustable by means of screws; **Dimensions**—27½ in. long, 12½ in. high; **Weight**—150 lbs.; **List Price**—$75.00.

No. 3 and 4 balancing ways are used for heavy work. They have a distance of 37 and 49 in. between standards and a height of 24½ and 37 in.; **Weight**—315, 1000 lbs.; **List Price**—$125.00, $350.00; standards of special height made to order.

Specially heavy type which will carry up to 6 tons. These are used in pairs of course and are built only to order.

Breuer Electric Mfg. Co.,

844 Blackhawk St., Chicago, Ill.



Portable Electric Blower
Catalog No. 6

Trade Name—"Tornado"; **Use**—Cleaning motors, generators and all electrical equipment; **Description**—Equipped with ⅓ hp. G. E. motor mounted on ball bearings; 32 to 250 volts; fan design and fan chamber give blower a water lift of over 19 in.; 11 in. insulated rubber nozzle; diameter discharge outlet, ¾ in.; toggle switch on handle; attaches to any light socket; **Weight**—7½ lbs.; **List Price**—$45.00; $10.00 additional for suction attachments; $5.00 for spraying attachment.

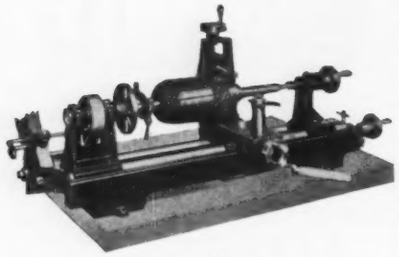
Catalog No. 8

Same as Model No. 6 except that it is a heavy duty type and as noted.

Trade Name—"Super Tornado"; **Motor**—2/5 hp.; **Weight**—9 lbs.; **List Price**—$60.00; fan and fan chamber give machine a water lift of 27 in.

Burton & Rogers Mfg. Co.,

857 Boylston St., Boston, Mass.

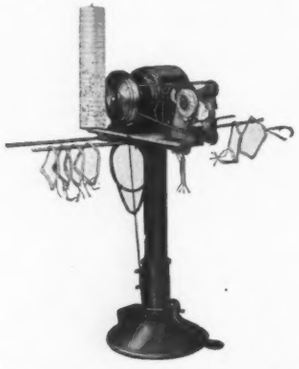


Undercutting Machine

Trade Name—"B & R"; **Use**—For removing insulation; **Description**—The cutter is fixed in a vertical spindle driven by a small belt. After the commutator has been turned down and the moving distance measured, the set screw can be locked and the motion controlled by the lever which increases the speed; **List Price**—$96.00, supplied with cutting tool, dressing fixture and extra undercutters.

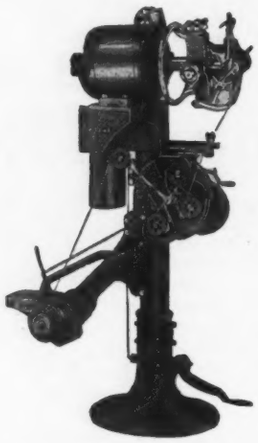
P. E. Chapman Elecl. Works,

1820 Chouteau Ave., St. Louis, Mo.



Armature Coil Taping Machine

Use—for taping armature coils from 3½ in. min. internal dia. to a straight bar; **Description**—This machine is mounted on a column base table; operated with foot pedal; equipped with motor, tape roll holder and coil pins; carries 36 yd. rolls of tape, ¼ to 1 in. wide; **List Price**—Not stated; also furnished separately with transmitter only, for bench mounting; other machines made for taping field coils.



Armature Winding Machine

Use—For production winding of armatures; **Special Features**—Automatic index, lead former, automatic lead discharger.

Commutator Soldering Machine

Trade Name—"Allatonce"; **Use**—For production soldering of commutators and rotors; **Special Features**—Speed; safety; no waste of solder.

Chicago Rawhide Mfg. Co.,

1287 Elston Ave., Chicago, Ill.

Catalog No. 22

Trade Name—"Chicago Rawhide"; **Description**—Mallets with solid rawhide heads and hardwood handles

No.	Dia. in In.	Length in In.	Weight in Oz.	Price Per Doz.
0	1	2⅛	2	$7.20
1	1¼	3	3½	8.64
2	1½	3¼	6	10 08
3	1¾	3¼	7½	11.52
4	2	3¼	10	14.64
5	2¾	4¼	21	32.40
6	2¾	4¾	23	36.60

Loaded rawhide mallets also available, made with lead core to give additional weight.

No.	Dia. in In.	Length in In.	Weight in Oz.	Price Per Doz.
7	1¼	3	8	$10.20
8	1¼	3⅛	12	11.40
9	1¾	3⅜	16	13.20
10	2	3½	20	16.44
11	2¾	4¼	42	36.48

Mallet handles $1.00 per doz.

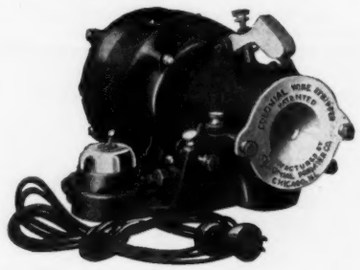
Rawhide faced hammers; rawhide faces inserted in malleable cast iron; wooden handles.

No.	Dia. in In.	Weight in Lbs.	Price Per Doz.	Extra Faces Per Doz. Pairs
0	1	½	$14.64	$5.04
1	1¼	1⅛	17.16	5.40
2	1½	1⅝	21.72	6.48
3	1¾	2¼	25.92	8.28
4	2	4	37.68	14.40
5	2¾	5½	48.00	20.40

Hammer handles $1.50 per doz.

Colonial Premier Co.,

225 W. Ohio St., Chicago, Ill.



Wire Stripper

Trade Name—"Colonial" **Use**—For stripping the ends of insulated wire; **Description**—Bench type machine with all moving parts enclosed. Rotating steel knives that cut all around the wire and twist the conductor if stranded are operated by centrifugal force instead of springs. Machine will strip all kinds of wire up to ½ in. in dia. The steel knives are replacable; **Motor**—¼ hp., G. E., ball bearing **Weight**—35 lb.; **List Price**—$200.00, 50 per cent off to dealers; equipped with 10 ft. of asbestos covered wire, soft rubber attachment plug at one end and detachable motor plug at the machine end.

Crane Puller Co.,

44 Chestnut St., West Newton, Mass.

Trade Name—"Crowfoot Crane Puller"; **Use**—For removing commutators, gears, pinions and pulleys from motors, etc.; **Description**—These pullers are made of high carbon steel, except the Crowfoot beams which are certified malleable castings. They are made in two styles, a Two-Arm Puller and a combined Two and Three-Arm Puller known as the Crowfoot Puller. These come in 4 sizes, No. 0, 2, 3 and 3x.

No. 0 Pullers

Small size for light work. Equipped with 3 and 6 in. arms. Accommodates diameters up to 6 in. Center screw ⅝ x 9 in.

	List Price
No. 0 Two-Arm Puller, weight boxed, 5 lbs.	$6.00
No. 0 Crowfoot Puller, weight boxed, 9 lbs.	9.00

No. 2 Pullers

Medium size. Equipped with 6 and 10 in. arms. Accommodates diameters up to 12 in. Center screw 1x14 in.

No. 2 Two-Arm Puller, weight boxed, 24 lbs. $14.00
No. 2 Crowfoot Puller, weight boxed, 37 lbs. 20.00

No. 3 Pullers

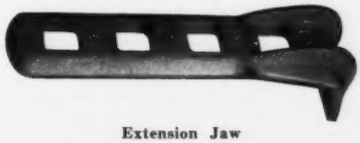
Large size. Equipped with 7 and 11 in. arms. Accommodates diameters up to 18 in. Center screw 1¼x17 in.

No. 3 Two-Arm Puller, weight boxed, 39 lbs. $20.00
No. 3 Crowfoot Puller, weight boxed, 65 lbs. 28.00

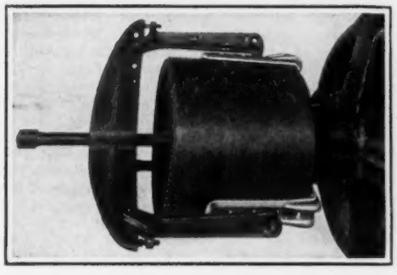
No. 3X Pullers

Extra large size. Equipped with 8 and 13 in. arms. Accommodates diameters up to 24 in. Center screw 1½x20 in.

No. 3X Two-Arm Puller, weight boxed, 65 lbs. $33.00
No. 3X Crowfoot Puller, weight boxed, 110 lbs. 50.00



Extension Jaw



Jaws Removing a Paper-Faced Pulley

Extension Jaws, designed for use with Crowfoot Crane Pullers for removing pulleys, especially paper-faced ones, etc., of the following dimensions:

Extension Jaws	Dia. in In.	Face in In.	Weight Boxed	Set of Jaws	List Price
No. 0	5	8	4	3	$3.75
No. 2	10	12	12	3	8.25
No. 3	18	22	25	3	13.50
No. 3x	24	26	25	3	13.50

Comstock Mfg. Co.,

319 Horton St., Wilkes-Barre, Pa.

Coil Winders

Trade Name—"Comstock"; **Use**—For winding armature and field coils; **Description**—These machines have an adjustable winding head and are equipped with a four wheel Veeder set back counter, and have a face plate on each end of spindle for winding either right or left hand coils. They have three speeds and are operated with a foot lever. Machines are either chain or belt driven; **List Price**—$278.00 and $418.00.

Armature Coil Forms

Trade Name—"Comstock"; **Use**—For making coils; **Description**—These forms are made of brass or grey iron. The coils are wound with a continuous turn and released by a lever when finished; **List Price**—$30.00 up. (Curved field and strap coil forms also available.)

Coil Presses

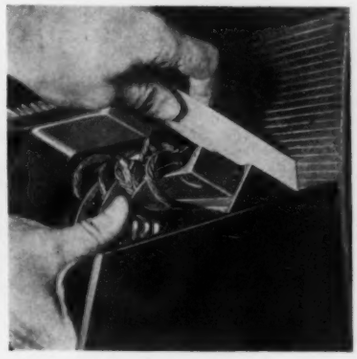
Trade Name—"Comstock"; **Use**—For pressing coils from 4 in. to 12 in and from 12 in. to 24 in.; **Description**—These presses are made of grey iron and steel, with wooden handles; **Dimensions**—(2 sizes) 12 in. and 24 in.; **List Price**—$54.00.

Co-Operative Utilities Co., Inc.,

1503 Columbia Ave., Philadelphia, Pa.

Commutator Stones

Trade Name—"Diamond-D"; **Use**—For resurfacing commutators and slip-rings; **Description**—"Diamond D" stones are made in four grades, Grade P, fine grade of stone for smoothing and polishing; Grade F, fine grade, used for finishing after the coarse grades are used; Grade R, light roughing stone to be used in field work; Grade H, heavy roughing stone designed for quick severe cutting; these stones are made in various standard sizes, 1 to 14 in. long, 1 to 8 in. wide, specify thickness; provided with stick, knob, straight, "U," "U" (series or parallel) style handles; **List Price**—Up to 3 cu. in., $.80 each; 3 to 50 cu. in., $.28 each cu in.; 50 cu. in. and up, $.25 each cu. in.; $.25 extra for handles.



Brush Seating Stones

Trade Name—"Diamond-D"; **Use**—For seating any metal or carbon brush to its ring or commutator; **Description**—The material in these stones is soft and of very fine texture and will not cut the commutator. The work is done while the machine is in operation with the brush in its holder. This means that each brush is brought to an exact seat and also places on the commutator or ring a fine glossy finish; **Dimensions**—4¾ x 1⅛ x ⅝ in.; **List Price**—$1.00 each; $6.00 per doz.

Despatch Mfg. Co.,

120 First Ave., N., Minneapolis, Minn.

Catalog Nos. B-10, B-15, B-20

Trade Name—"Despatch"; **Use**—For drying and baking small coils and armatures; also for baking japans and lacquer on small motor parts and enamel on fittings; for testing in industrial laboratories and other processes requiring temperatures up to 400 deg. Fahr.; **Description**—These ovens are designed especially for those not desiring a production oven. They have the adjustable shelf arrangement and the three heat control system for the heating elements, which are open wire type, located in bottom of ovens; low, medium and high temperatures up to 400 deg. Fahr. obtained. **Dimensions**—(Inside) 18 x 14 x 14, 24 x 14 x 14, 30 x 18 x 24; (Outside) 20 x 15 x 21, 26 x 15 x 21, 33 x 19 x 31 in. high; **Capacity**—2.05, 2.73, 7.50 cu. ft.; **Finish**—Aluminum bronze lacquer; **Weight**—115, 124, 220 lbs. (shipping); **List Price**—$55.00, $75.00, $165.00; $115.00, $135.00, $224.00 for electric-heated bi-metallic thermostat temperature control; these ovens are arranged with either gas or electric heaters and with or without automatic temperature control; shipped completely erected.

Catalog Nos. C-15, C-20, C-25

Trade Name—"Despatch"; **Use**—For low temperature drying and baking of coils and armatures; of paints and enamels; for drying out moisture and baking various substances, including all process work requiring temperatures up to 300 deg. Fahr.; **Description**—These ovens are made of steel; C-15 have single swinging doors; C-20, double and C-25 have three; heavily constructed doors with double walls, 1 in. insulation; equipped with mercurial thermometers, located on right side of ovens; three heat switch controls temperature, approximately 190 deg. Fahr. on low heat, 220 deg. Fahr. on medium and 300 deg. Fahr. on high heat; open wire type heating elements mounted in the bottom heater space; **Dimensions**—(Inside) 30 x 34 x 36, 60 x 34 x 36, 90 x 34 x 36 in. high; (Outside) 3; **Capacity**—22.5, 45, 67.5 cu. ft.; **Finish**—Aluminum bronze lacquer; **List Price**—$107.00, $155.00, $209.00; shipped knocked down with complete instructions for erection; they can be arranged to suit any voltages and current specifications and for natural or artificial gas.

Catalog No. S-20

Trade Name—"Despatch"; **Use**—For baking coils and armatures; baking japans and enamels; baking and drying of cores and molds in foundries and other drying and baking processes requiring temperatures up to 500 deg. Fahr.; **Description**—Large Kiln type two compartment oven of steel panel construction with double walls of 2½ in. insulation; top and bottom ventilators, including regulating dampers; one compartment arranged for truck loading; automatic temperature control; steel cabinet on left side of ovens, equipped with fuse protection, magnetic switch, pilot light and remote control switch; **Dimensions**—(Inside) 4 x 7 x 5 ft.; (Outside) 5 ft. 9 in. x 7 ft. 5 in. x 5 ft. 5 in. high; **Capacity**—140 cu. ft.; **Finish**—Aluminum bronze lacquer; **Weight**—3000 lbs. (shipping); **List Price**—$817.00; these ovens are knocked down with complete instructions for erection; type S ovens are made in many sizes, equipped with either gas or electric heaters, hand or automatic control.

Catalog No. F-30

Trade Name—"Despatch"; **Use**—For drying and baking coils and armatures, etc.; temperatures up to 500 deg. Fahr.; **Description**—Small heavy duty ovens with either gas or electric heating systems, and come with or without automatic temperature control; arranged with a series of open wire type electric-heating elements of the low gradient and graduated type mounted in the bottom heater chamber controlled with 3 heat switch, low, medium or high; **Dimensions**—(Inside) 2 x 3 x 2 ft. high; (Outside) 2 ft. 6 in. x 3 ft. 4 in. x 2 ft. high; **Capacity**—12 cu. ft.; **Finish**—Aluminum bronze lacquer; **Weight**—650 lbs. (shipping); **List Price**—$205.00; shipped completely erected; type F ovens are built in 4 smaller and 5 larger sizes than the one mentioned above.

Type J ovens are used for medium-sized heavy duty work; arranged for either shelf or truck loading; made in 10 sizes; **Capacity**—32 to 98 cu. ft.; **Weight**—900 to 2000 lbs. (shipping); **List Price**—$343.00 to $715.00 (3 heat temperature control); shipped completely erected.

Type N heavy duty ovens, arranged with electric, oil or gas heating systems also with or without automatic temperature control; two or more doors arranged so that any one of them may be opened independently, reducing

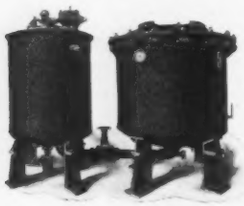
loss of heat; made in 5 sizes; **Capacity**—13 to 74 cu. ft.; **Weight**—600 to 1400 lbs.; **List Price**—$317.00 to $671.00 (3 heat temperature control); shipped completely erected.

Type No. 298 is a combination truck and hand loading oven, arranged complete with automatic temperature control, safety door switch, time clock and pilot light. This installation offers a very good suggestion for the handling of heavy armatures in the oven and also a method of applying the varnish; **List Price**—Noted stated.

Note: Special ovens built to order.

J. P. Devine Mfg. Co.,

1372 Clinton St., Buffalo, N. Y.

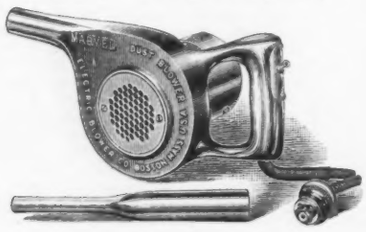


Catalog No. 104-A

Trade Name—"Devine"; **Use**—For drying and impregnating coils, armatures, cables, condensers, etc.; **Description**—The impregnating chamber and liquor tank are made of soft open-hearth steel with the cylindrical and vertical seams welded. Cast steel rings, covers and flanges are furnished. When a unit is fitted with coils, they are made of extra heavy welded wrought iron pipe. Equipped with all necessary mountings, steam jacketed connections, condenser and combined vacuum pump and air compressor. These ovens are made in 13 standard sizes; **Dimensions**—14 x 18 to 108 in. dia. x 240 in. high (impregnating chamber and liquor tank); 5 x 3 x 11 to 43 x 15 x 40 ft. long (space occupied by apparatus); **Weight**—(Apparatus) 2,700 to 125,000 lbs. approx.; **List Price**—Not stated; apparatus built to order of any size for every requirement.

Electric Blower Co.,

352 Atlantic Ave., Boston, Mass.



Portable Dust Blower

Trade Name—"Marvel"; **Use**—For blowing dust and dirt out of armatures and other electrical equipment; **Description**—(Type) Air-cooled; gives 15 to 18 in. water column pressure; toggle switch on handle; **Motor**—1/9 hp.—Universal with Norma ball-bearings; **Weight**—6½ lbs.; **List Price**—$45.00, includes 20 ft. rubber-covered cable and plug; $10.00 additional for vacuum cleaner attachments.

Electric Service Supplies Co.

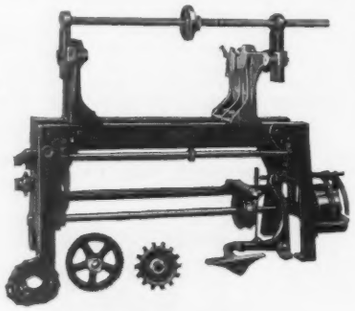
17th and Cambria Sts., Philadelphia, Pa.

Commutator Slotting Machine

Trade Name—"Peerless," Type S; **Description**—This machine is mounted on a heavy angle iron steel base with suitable feet for bolting to the floor, although this is not necessary as the weight of the machine is ample to hold it rigidly. The armature is supported in a V bearing at the commutator end, which bearing is guided by two vertical rods and is adjustable vertically for different diameters of commutators. The upper part of the machine is pivoted to the lower supports and is therefore capable of being swung backward for more readily placing the armature shaft in the V bearing. The saw shaft is supported in a long bearing bolted to the sliding cross head support by two steel rods projecting over the commutator. This sliding head is operated across the commutator slots by means of a lever with holes for various adjustments. The cross head bearings are split with proper shims to take up the wear; **Weight**—500 lbs.; **List Price**—$350.00 complete with ⅓ hp. motor, $320.00 without motor.

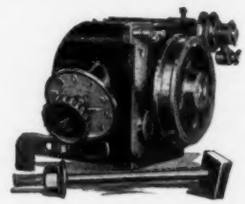
Armature Winding Stand

Trade Name—"Peerless," Type A; **Description**—These stands are designed for normal use with the operator in a standing position. They are constructed of two cast iron standards mounted on angle steel sills, one standard permanently attached to the sill, the other being adjusted to various lengths of armatures. They are of substantial construction which prevents them becoming shaky or unsteady after long usage. They are mounted on 3-inch diameter castors, fitted with roller bearings, enabling them to be moved around the shop by one man for mounting or removing armatures. The armature rests on 1 inch wide brass rollers. They are provided with safety stops to keep them in position. These stands have an adjustment in height of from 33 inches to 40 inches, and are designed for the operator to work in a standing position. They are provided with hinged shelves at each end, which serve as a receptacle for tools while winding, or as a seat for the operator when putting leads into the commutator slots; **Weight**—265 lbs.; **List Price**—$80.00.



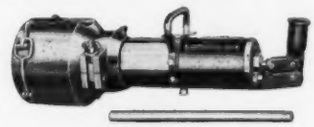
Armature Banding Machine

Trade Name—"Peerless," Type A; **Description**—This machine is designed for handling railway and industrial motor armatures of all sizes and types up to the capacity of the machine which will allow for a maximum armature diameter of 30 inches. The armature revolves on soft brass rollers instead of on its centers, the back roller being adjustable to accommodate various diameters of shaft and both bearings are adjustable along the bed plate, so that they may be placed against the oil flanges at each end of the armature, thus obviating the necessity of using set collars. The band wire is fed to the armature by a hand feed wheel in a grooved pulley, which wheel is carried by a heavy steel shaft having square threads (four to the inch), making it possible to shift from one band to the other with great speed. This feed rod is adjustable vertically and also in and out and thereby will accommodate various sizes of armatures. A foot pedal automatically applies the brake and prevents any slack from accumulating on the band wire. The armature proper is driven by a clutch sprocket applied directly to the armature pinion, which clutch will handle a pinion having a maximum outside diameter of 10 inches. A second clutch sprocket is supplied for driving armatures that are not fitted with pinions; this clutch will handle shafts up to 4 inches in diameter. Two sets of spur gears and sprocket wheels are also supplied, producing a total of four speeds, and a socket wrench is furnished for operating the clutch jaws. Also fitted with tight and loose pulleys, 10 in. dia. for 2¼ in. belt, to be operated at about 100 r.p.m.; **Weight**—750 lbs.; **List Price**—$450.00.



Band Wire Tension Machine

Trade Name—"Peerless," Type P; **Description**—This machine is designed to meet the demand for a light, portable tension device, which can be used to the best advantage in connection with an ordinary lathe for rotating the armature, but is equally as efficient with any other method that may be in use for this purpose. It is applied to a lathe by simply removing the tool post and inserting a bolt, which clamps the machine to the cross slide. This machine consists of a friction tapered drum so designed that it neutralizes the tendency of the wire to creep. The amount of tension is under perfect control of the operator and is regulated by ten-point index. The gearing, brake, etc., are all placed inside the casing, and are of ample strength, with large bearing surfaces; all bearings are readily lubricated from the outside by holes through the shaft. This machine will hold the tension absolutely uniform throughout the operation, without the slightest injury to the band wire or the generation of heat. Each pound applied to the brake drum is multiplied by means of gearing to 3 pounds at the band wire drum, which is tapered to compensate for the tendency of the wire to crowd up against the flange. On account of this gear reduction, a comparatively small braking effect produces a very great tension on the band wire, and any change in tension can be instantly secured by regulating the hand nut, directly in front of the operator; **Weight**—45 lbs.; **List Price**—$85.00.



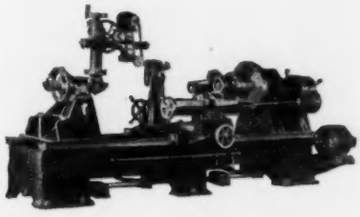
Pinion Puller

Trade Name—"Peerless"; **Description**—Designed for easy and rapid removal of pinions from armature shafts, and being portable it can readily be carried by one man to the armature from which the pinion is to be removed. The machine is used in connection with special cast steel split jaws which clamp over the pinion, pulling in a straight line, and therefore can be applied to the armature without removing the latter from the motor, it being unnecessary to either block up the puller or the motor; **Weight**—50 lbs. (without jaws); **List Price**—$180.00 complete (without jaws); (pinion puller jaws from $27.50 to $72.00 each).

Armature Buggy

Trade Name—"Peerless," Type J; **Description**—Designed to offer a convenient means of

handling armatures around the shop and for placing them in baking ovens. They consist of a strong, compact truck made entirely of metal, which occupies but little more space than the armature itself. They can be either drawn or pushed, having a pivoted castor on either end which makes them easy to guide or pass over any obstruction. The armature shaft is protected against damage by two 1¼-inch wide bronze rollers; **Weight**—135 lbs.; **List Price**—$62.50.



Universal Armature Machine

Trade Name—"Peerless," Type H (extra heavy duty); **Description**—Complete machine consisting of armature banding machine with tension device, commutator slotting attachment with motor, commutator grinding attachment with motor, commutator turning attachment with tool post, arranged with gear and bracket for direct motor drive. The complete machine includes fine and coarse grinding wheels, socket wrenches for the clutch and tool posts, belts for the grinding and slotting attachment motors, suitable guard for all power operated gears and cast iron bracket for the main motor, which is bolted directly to the base of the machine, thus making one unit. Independent motor for operating the grinding attachment is ¾ horsepower, 1750 r.p.m., while the motor for the slotting attachment is ¼ horsepower, 1750 r.p.m.; **Weight**—5500 lbs.; **List Price**—$4,312.50 (without main motor).

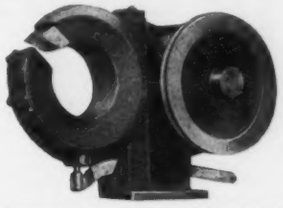
Floor Crane

Trade Name—"Peerless"; **Description**—These floor cranes constitute labor-saving equipment for use in shop work in handling armatures, motors, wheels and other heavy pieces of apparatus. They have a high lift, deep over-hang, low base, strength and sufficient lifting capacity and combine these necessary features with lightness in weight so that one man can move the crane with capacity load. These cranes have a steel superstructure and a combination cast iron and heavy I-beam base, made in three capacities and sizes as listed below:

Capacity, Tons	Lift	Over-Hang, Inches	Height Over All	Weight	List Price Each
½	6 ft.	30	6 ft. 8 in.	300	$87.50
1	6 ft. 6 in.	35	7 ft. 6 in.	500	125.00
1	7 ft.	35	8 ft.	515	131.25
1	7 ft. 6 in.	35	8 ft. 6 in.	525	137.50
2	7 ft.	38	8 ft. 2 in.	750	175.00
2	7 ft. 6 in.	38	8 ft. 8 in.	770	183.75

Magnet Wire Reel Rack with Tension Device

Trade Name—"Segur"; **Description**—For mounting reels of magnet wire used in coil winding and for supplying proper tension for same. The rack is of angle iron construction and has a capacity of four 24-inch diameter, 200-pound spools of wire or many more smaller spools. It puts individual tension on groups of wires and thereby greatly facilitates the winding of multiple wound coils; **Dimensions**—4¼ sq. ft. (floor space); **Weight**—126 lbs.; **List Price**—$58.50 (with tension device complete); $40.50 (without).



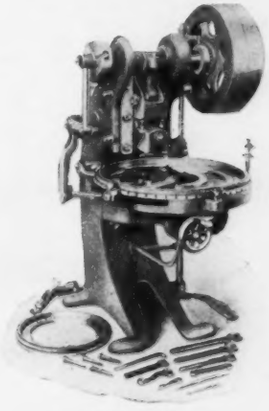
Field and Magnet Coil Taping Machine

Trade Name—"Segur"; **Description**—These machines have operating parts made entirely of steel and bronze, and are internally gear-driven with a belt drive from motor or other source of power. The taping wheel and tension device are entirely concealed, and thus are harmless to the operator and to the coils. With these machines it is possible to tape from 50 to 90 coils per hour, depending upon the size and style of coil and the efficiency of the operator; rolls or spools of tape containing 1000 yards being generally used. The tension on the tape is controlled by the operator's knee by means of brake attachment supplied with the machine.

Width of Tape	Hole Dia.	Width of Opening	Pulley Dia.	Shipping Weight	List Price
¼ in.	1 1/16 in.	1/16 in.	2¾ in.	22 lbs.	$100.00
½ in.	2 in.	⅞ in.	3¾ in.	28 lbs.	105.25
¾ in.	2 1/16 in.	1 1/16 in.	4½ in.	31 lbs.	110.25

Note: Lathe heads, copper bar benders, power transmitters for use with coil and field taping machines, jacks, commutator stones, also available.

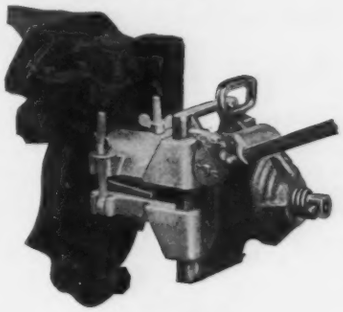
Ferracute Machine Co.,
Bridgeton, N. J.



Disk Notcher
Catalog No. C-82

Trade Name—"Ferracute"; **Use**—For notching armatures; 400 strokes and up per minute; **Description**—This machine is adapted for notching internal work, that is with the notches upon the inside edge of a ring-like disk. This change is made by taking off the "external" carriage, with its spindle, spider, pawl-lever and other appurtenances and substituting therefor the new and larger carriage shown. For disks having an inside diameter from 3 to 12 in., with an outside diameter from 6 to 15 in., a small sized ratchet-holder is used. This will receive the 18 in. ratchets which are used upon the spider of the external machine. For disks with an outside diameter of from 15 to 24 in. a large sized ratchet-holder is used. Machine has a 175 lb. fly-wheel, 20 in. in dia. and 3 in. wide, with speed of 200 to 400 r.p.m.; **Motor**—2 hp.; **Dimensions**—22 in. wide, 27 in. deep (Floor-space); 60 in. high; **Weight**—1400 lbs. (about); **List Price**—(Internal) $970.00; (External) $825.00 including ramblock, 1 ratchet and 1 center plate; (Equipped for both external and internal work) $1,200.00.

Duff Mfg. Co.,
Pittsburgh, Pa.



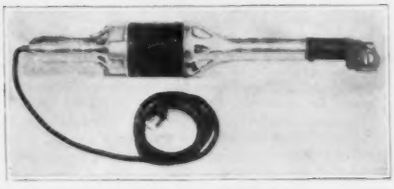
Pinion Puller

Use—For pulling motor pinions or pulleys from shafts; **Weight**—50 lbs.; **List Price**—$120.00; **Special Features**—Uniform pull around entire periphery of the prism; worm and screw action; quick "run-out" for rapidly bringing end of screw into contact with pinion shaft.

Armature Lift

Use—For removing armatures from under street car bodies, etc; **Capacity**—3 tons; **List Price**—$75.00; **Special Features**—Fine adjustment with large hand wheel—has side adjustment of 6 in.

Green Equipment Corp.,
Monadnock Block, Chicago, Ill.



Commutator Slotters
Catalog C and J

Trade Name—"Aurand"; **Use**—For undercutting mica; **Description**—Portable hand type;

motor driven; using 1½ in. saw on C and 11/16 in. on J; **Capacity** (C) 8 in. and up; (J) any size; **Dimensions**—(Length) 24 in.; 12 in.; **Weight**—10; 5 lbs.; **List Price**—$150.00; $90.00.

Trade Name—"Acme"; **Use**—For grinding and finishing commutators and collector rings; **Description**—Blocks of artificial abrasive mounted with suitable handles; **List Price**—Sizes up to 4 cu. in., $1.00 each; 4 to 49 cu. in., 25c. per cu. in.; 50 cu. in. or more, 20c. per cu. in.; 50c. extra for handles; Acme stones are made to order in any size or shape.

George M. Griswold Machine Co.,

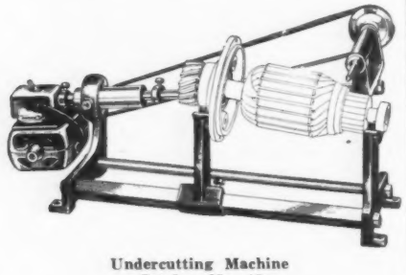
Bradley and William Sts., New Haven, Conn.

Coil Taping Machine

Trade Name—"Griswold"; **Use**—For taping armature coils; **Description**—The capacity of this machine depends solely on skill of operator. It has a speed of about 350 r.p.m.; operated by foot pedal; **Dimensions**—Floor space, 2 x 1 ft. with 8 x 2 in. driving pulley; slot ⅞ in. wide; **Weight**—130 lbs.; **List Price**—Not stated.

Hullhorst Micro Tool Co.,

3242 Monroe St., Toledo, Ohio



Undercutting Machine
Catalog No. 15

Trade Name—"Hullhorst"; **Use**—Removes mica from all armatures with or without centers in shafts, also those with high rises; **Description**—This machine has V blocks instead of centers. It has a balanced motor-spindle arm. Bearings, gears or flanges don't have to be removed as mica is undercut to a uniform depth whether the commutator sets level on machine or not. Its steel disc cutter is mounted on a long, strong arbor, controlled in both directions by adjustable stops on the sliding arm. The ¼ in. cutter cuts 1/32 in. deep. Toggle control switch mounted above motor; belt connected; **Motor**—110 volt universal G. E. (D.C., or 25 to 70 cycle A.C.); **Finish**—Castings are painted dark olive green; motor and handle black; steel parts bright; **Weight**—9½ lbs.; 15½ lbs. boxed; **List Price**—$24.80 includes 6 ft. cord and plug; nine ¼ in. cutters, assorted thicknesses.

Mica Undercutting Machine
Catalog No. 7

Trade Name—"Hullhorst"; **Description**—This machine is mounted on a rigid bed with 3 point suspension legs which sets firmly whether fastened to bench or not. Spindle and arbor are made of crucible steel, run on liberal sized bronze bearings, mounted rigidly in the handle casting. Arbor is 3/16 in. at cutter-end. Motor-end counterbalances the spindle-end and raises the cutter from the commutator when handle is released. Cutter travels through a swinging toggle mechanism which has two pivot points. Depth of cut assured by adjustable stop-gauge, threaded and locked with a set-screw; **Motor**—110 volt Universal, operates on either D.C. or 25 to 70 cycle A.C.; **Capacity**—Takes armatures up to 6 in. in dia. and shafts up to 18 in. long; **Weight**—29 lbs. (shipping); **List Price**—$48.00 includes 6 ft. cord and plug; twenty ¼ in. disc cutters, 4 each of .015, .020, .025, .030 and .035 in. thickness.

Commutator Truing and Undercutting Machine
Catalog No. 8

Trade Name—"Hullhorst"; **Use**—For truing, undercutting and polishing commutators; **Description**—The machine bed is mounted on three point suspension legs, adjustable to set solidly on any bench surface. A three-speed cone pulley is provided on both counter-shaft and machine for changing speed as desired. The undercutting unit operates on a steel bar; **Motor**—110 volt Universal, for driving cutter-spindle; operates on either D.C. or 25 to 70 cycle A.C.; no motor furnished for turning unit; a ¼ hp. is ample for operating it; **Capacity**—Swing work 6 in. in dia. over bed; 4½ in. over compound slide rest; takes 18 in. between centers; travel of center in tail stock 2¼ in.; **Weight**—76 lbs. (shipping); **List Price**—$115.00 includes 6 ft. of cord and plug; twenty ¼ in. disc cutters, 4 each of .015, .020, .025, .030 and .035 in. thickness.

No. 8A—Equipped with No. 8 machine and motor for turning unit, all mounted on a bench, $160.00.

No. 9—Lathe type mica undercutting machine, will operate on any large lathe, $80.00 including A.C. or D.C. motor.

No. 10—Heavy duty mica undercutter, without motor, $150.00.

Catalog No. 2

Trade Name—"Hullhorst"; **Use**—For removing mica from armatures; **Description**—Portable mica undercutter, has strong flexible shaft protected by a flexible metal sheath. Can be suspended with a chain on a tripod or other object for operation with any motor having ½ in. dia. shaft; 9/32 in. disc cutter cuts 1/32 in. deep. Small fan operated with the shaft keeps cutter path clear. Spindle is made of steel with ground cone bearings. Cutter arbor is removable and fits perfectly into a tapered hole in the spindle. Handle bracket also removable; **Capacity**—Up to 36 in. dia. commutators; 60 in. at extra cost; **Weight**—7 lbs. (shipping); **List Price**—$62.00 without motor, including 20 cutters; $18.00 extra for A.C. 60 cycle 110 volt motor; $21.00 for D.C. 110 volt.

No. 6—Portable machine with motor, $44.00, furnished with wooden carrying case with leather handle.

Ideal Commutator Dresser Co.

Sycamore, Ill.

Commutator Slotting Files

Trade Name—"Ideal"; **Use**—For undercutting mica, leaving a "V" shaped slot; **Description**—These files are made in two styles, "Single End" and "Double End." The Single End file is equipped with a wooden handle; **Dimensions**—3 sizes; in lots of 1, 6 and 12; **List Price**—Single End, wooden handle, $.80, .60 and .55 each; Double End, small 7 in., $.90, .70 and .65 each; Double End, large 8 in., $.95, .75 and .70 each.

"Ideal" portable electric blower equipped with ⅓ hp. air-cooled universal motor furnished for from 64 to 250 volts, Norma ball bearings. Used for blowing dust out of motors; **Weight**—9⅓ lbs.; **List Price**—Not stated; 20 ft. rubber covered cord furnished.

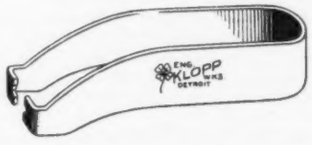
"Ideal" Tool Rest is simple in construction and light enough to be easily portable. Bases are available in lengths from 6 in. to 28 in., varying by 2 in. Those 14-in. or smaller have two supports while the 16-in. or longer bases have three supports. Supports are "L" shape either 2 or 3 in. high, or "T" shape 3 in. high for attaching to round brush arms. Flat supports can be substituted when necessary to attach to flat brush arms. Specify type of supports wanted. Each base has a large diameter wheel to facilitate easy operation of cross feed; also a screw infeed adjustment. Will take 2 x 2 in. face cutting stone or smaller of any length. Commutators are resurfaced or trued up in their own bearings, at normal speed; **Weight**—45 lbs. (12 in. tool rest); **List Price**—$97.00 (12 in. base); $3.00 extra for each additional 2 inches.

Commutator Resurfacer

Type—Double "U" Handle; Use—For resurfacing commutators and slip rings; Special Features—Made in four grades (coarse, medium, finish, polish.)

Klopp Engineering Works,

226 Bates St., Detroit, Mich.



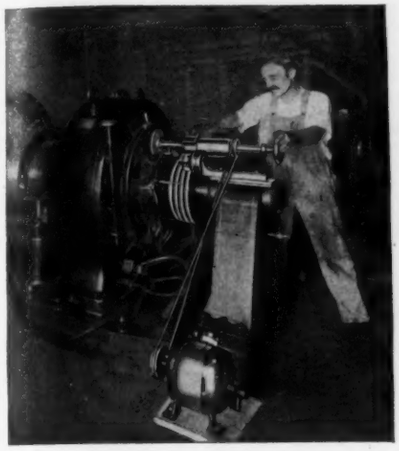
Wire Insulation Scrapers

Trade Name—"Klopp"; **Use**—For removing insulation from wire; **Description**—This device is made of steel, shaped to fit the hand and has sharp V slots to engage and remove the insulation; **List Price**—$.65.

Armature air gap gauges; 8 and 16 in. feeler gauges with 8 and 6 replaceable blades; made in three sizes; **List Price**—$1.50 and $3.00 each.

Fibre wedge driver, standard sizes, 7/32 x ⅞; 3/16 x ⅝; 1/16 x ½; ⅛ x ½; ⅛ x 7/16; ⅛ x 9/32 in.; **List Price**—$2.40 each.

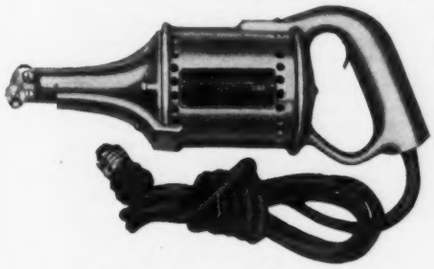
Jordan Bros., Inc.,
76 Beekman Street, New York, N. Y.



Commutator Truing Device

Use—For grinding commutators and slip rings in their own bearings without a shutdown.

Martindale Electric Co.
1260 W. Fourth, Cleveland, Ohio



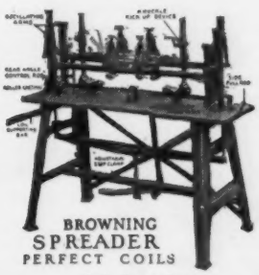
Portable Commutator Slotter No. 13

Use—For undercutting mica in commutators; **List Price**—$90.00 (includes 6 No. 13 assorted saws)—Extra saws $4.00 per doz. in 13 sizes from .015 in. up to .045 in.; **Special Features**—Light and convenient to handle. Has universal motor for 110, 220 and 250 volt service.

Mutual Foundry & Machine Co.
Atlanta, Ga.

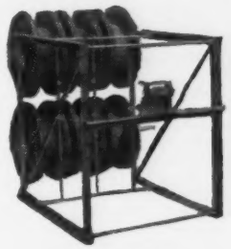
Loop and Field Coil Winder

Trade Name—"Browning"; **Use**—Designed for the rapid production of loops by inexperienced operators and for winding field coils and transformer coils, as well as for reeling wire; **Capacity**—5½ in.—30 in. loops on standard head, or 48 in. loops, using extension arms; width, ⅝ in.; height, ⅞ in.; **Dimensions**—(floor space) 41 in. x 45 in.; **Motor**—1 or 1½ hp. (countershaft 450 r.p.m.); **Weight**—750 lbs. (shipping); **Note**—Furnished for right or left hand operation; also furnished with belt drive; **Special Features** — Heavy duty self-contained unit; saves space; is equipped with "Veeder" set-back revolution counter; perfect control.



Coil Spreader

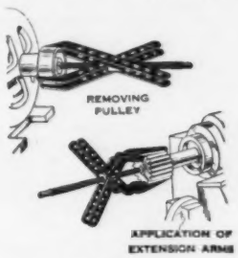
Trade Name—"Browning"; **Use**—Holding and shaping field coils; **Capacity**—Coils ⅛ in. to ¾ in. wide and ¼ in. to 1 in. high, 30 in. or 42 in. long; **Dimensions**—(floor space) 30 in. x 60 in. and 30 in. x 72 in. x 55 in. high; **Weight**—540 and 590 lbs.; **Special Features**—(Compensating feature) rear holders are automatically pulled down by control rods, producing correct pitch on slot portions of coil by bringing the bottom of the rear slot section to the same radius as the top of front slot section; accurate adjustment; speed.



Reel Rack

Trade Name—"Browning"; **Use**—For reeling wire to winding equipment; **Dimensions**—40 in. wide, 48 in. long, 46 in. high; **Weight**—350 lbs. (shipping); **Special Features**—Furnished with "Browning" tension device for securing tightly wound and compactly formed loops.

Premier Electric Co.,
3832 Ravenswood Ave., Chicago, Ill.



Gear and Wheel Puller
Catalog No. 8

Trade Name—"Little Giant"; **Use**—For pulling gears, wheels, bearings, pulleys, etc.; **Description**—This device has four long, slim drop forged puller arms which are adjustable up to 13 inches for outside or inside pulls. It is adapted especially for pulling timing gears or where space is limited by closely fitting gear cases, etc. The extension arms allow long reach for smallest diameters. This puller permits adjustment of one or more arms to different lengths for uneven inside or outside pulls. Maximum strength for size, arms drop forged, tested for 10-ton direct pull. No arm locks required; can't slip off work; **List Price**—$12.00 complete with extension arms; "Little Giant" service parts, P-540 Arm, P-541 Screw, P-542 Center Block, P-544 Extension Arm, $2.00 each; P-547 Washer, $.25.

Catalog No. 9

Same as No. 8 except as noted.

Trade Name—"Big Buster"; **Use**—For pulling motor truck and tractor wheels, boat and aeroplane propellers, heavy fly and gear wheels, pinions, transmissions, drive wheels, etc.; **Description**—This is a heavy duty tool designed to cover a range of work upward where the "Little Giant" and other tools leave off. Has an open adjustment to 40 inches, normal; 50 inches, extreme; a direct pulling power of 50 tons easily obtainable; **Weight**—100 lbs.; **List Price**—$50.00 complete with wrench and handle; "Big Buster" service parts, P-650 Arm, P-651 Screw, P-652 Center Block, $8.00 each; P-653 Washer, $.25; P-654 Wrench, $3.00; P-655 Handle, $1.50.

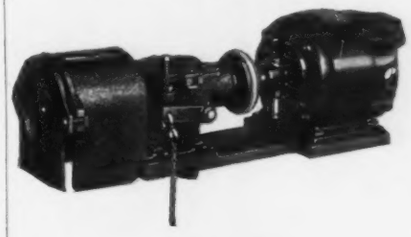
Note: New patented principle, "The Harder the Pull—the Tighter the Grip."

Pyramid Products Co.,
2311 S. State St., Chicago, Ill.

Wire Stripper

Trade Name—"E-Z"; **Use**—For stripping insulation from stranded and solid center wire; one-inch strip with every clip; **Description**—The cutting edges are shielded and the blind centers of the V notches on the blades prevent injury to wire. The handles are checkered and full nickel plated; **Capacity**—10 ft. per minute; **Dimensions**—7¾ x 3 x 1¾ in. high (packed); **Weight**—1 lb. (shipping); **List Price**—$3.25.

Service Sales & Mfg. Co.,
17005 Melgrave Ave., Cleveland, Ohio



Wire Stripper

Trade Name—"Hartman"; **Use**—For removing mica from armatures; **Description**—This machine twists and polishes the wire as it strips off the insulation. The adjustment for different sizes of wire is made entirely from one externally operated screw. Two sizes of this machine are available, Model A for wire of 0-⅜ in. dia. over the insulation and Model B for wire ¼ to ⅜ in. It is furnished with a 110 volt A.C. motor, but D.C. motors or motors of other voltages may be obtained on order; **List Price**—Not stated.

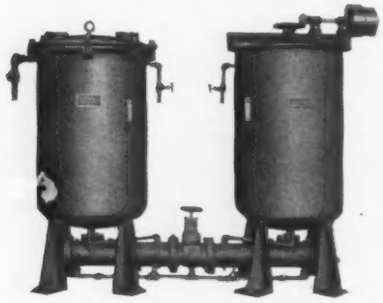
B. F. Sturtevant Co.
Hyde Park, Boston, Mass.

Portable Blower

Trade Name—"Big Midget"; **Use**—For blowing dust and loose matter out of motors; **Motor**—1/6 hp. universal, 110 or 220 volts; **Weight**—7 lbs.; **List Price**—$44.00 (includes 20 ft. of reinforced cord and plug); **Special Features** — Handle on the top, avoiding wrist strain; switch in handle.

F. J. Stokes Machine Co.,

5834 Tabor Road (Olney P. O.), Philadelphia, Pa.

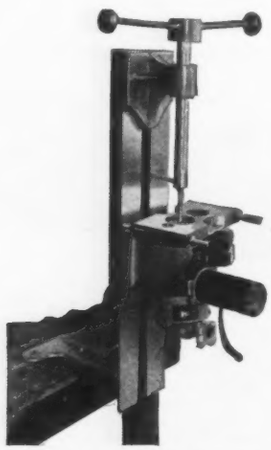


Vacuum Impregnating Apparatus
Catalog No. 26

Trade Name—"Stokes"; **Use**—For impregnating coils, armatures, condensers, transformers, wooden parts, etc.; **Description**—The apparatus consists of an impregnating chamber and a liquid tank. All air and moisture is removed from the spaces and pores in the article to be treated by the use of heat and high vacuum, and then while still under vacuum, the hot impregnating compound is syphoned in completely submerging the material. A heavy pressure is then applied which forces the compound into every pore and crevice; **Dimensions**—Standardized tanks having diameters varying by 6 in. from 12 up to 60 in. dia., also 72 and 80 in. dia.; tanks can be built in any size; **List Price**—Not stated.

Joseph Weidenhoff, Inc.,

4352 W. Roosevelt Rd., Chicago, Ill.



Off-and-On Puller Press
Catalog No. 967

Trade Name—"Weidenhoff"; **Use**—For removing and replacing all sizes and types of bearings, races, gears, couplings, slip rings, clutches, end caps, Bendix Drives and commutators; **Description**—This device has the combined features of a quick acting arbor and puller press. It has a steel casting adjustable table, throat of which is large enough to take the largest generator or end housing; table can be raised or lowered in steps of 3½ inches. Uprights are made of 3 in. angle iron. The All-in-One puller plate is machined to take every size fitting from the smallest magneto bearing to the largest gear. They are open slotted on opposite ends so that they can be reversed without removing studs. Hardened and tempered to resist wear and distortion under pressure. For removing races, it is of special importance, because the machined edges are thin, yet strong enough to fit into the race of any bearing, such as magneto races that are flushed against the slip ring; **Dimensions**—32 in. overall height of press; **Weight**—122 lbs. (press complete); **List Price**—$47.00 puller press with plates; $10.00 extra for individual angle iron stand, No. 967B; No. 969, plates only, $7.50 per set.

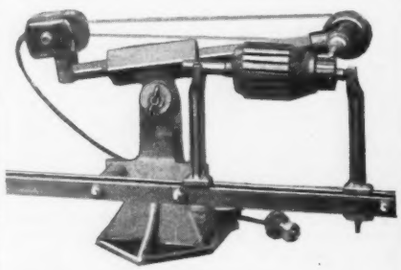
Nos. 980 and 981—Steel hand, terminal and gear pullers with extra heavy drop forged jaws which have teeth designed to get behind work in tight places. Pullers have maximum jaw openings of 2½ x 1½ and 3 x 2½ in. high; **List Price**—$2.00 and $3.00.

Combination Tool
Catalog Nos. 973 and 974

Trade Name—"Weidenhoff"; **Description**—The most stubborn pole piece screw is instantly released without marring screw head or frame. In the same efficient manner pole pieces are quickly pulled into position through terrific pressure applied at the screw head. Ratchet operates right or left hand for releasing or tightening screws. Fixture accommodates all size frames which are protected by felt pad. Removable screw driver bit is hardened and tempered. For securely holding frames while being worked on an adjustable clamp is furnished when ordered. This attachment is shown in the illustration; **List Price**—$24.00 for Ratchet Screw Driver No. 973; $4.10 additional for Hold Down Clamp No. 974.

"Simplex" Mica Undercutter
Catalog No. 970

Trade Name—"Weidenhoff"; **Use**—For cutting mica from armatures; **Description**—Portable hand, flexible shaft undercutter. Fitting on end of shaft fits chuck of any electric drill of ¼ in. or more capacity. Standard dental cutting burr is chucked in end of hand piece and is guided with little effort to follow slot in commutator; **Weight**—4 lbs. (shipping); **List Price**—$17.50 including 12 cutting burrs; $2.00 per doz. for No. 953A cutting burrs only.



Junior Undercutter
Catalog No. 975

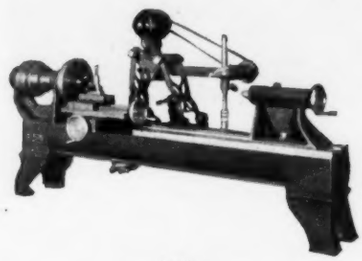
Trade Name—"Weidenhoff"; **Description**—A special bearing of substantial proportions guides the slide rod which is keyed to prevent hand piece turning. The design here employed features a slide rod of short length yet permits cutter to travel 4½ inches. Cutter spindle being close to bearing prevents chatter when cutter is working in hard mica. Extremely sensitive operation through correct balance. Adjustable stop governs stroke. Motor adjustable for belt tension. Standards which support armature have V slot for centerless types; **List Price**—$27.50 includes 6 saw cutters, cord and plug; No. 953C assorted saw type cutters, $3.50 per doz.

Mica Undercutter
Catalog No. 963

Trade Name—"Weidenhoff"; **Description**—The spindle which carries the cutter is adjustable for any commutator to 6 inch diameter. Spindle raised and lowered on spindle support rod which supports spindle full length of stroke and controls depth of cutter in slot. Adjustable stop prevents cutter striking armature winding on back stroke. Maximum stroke of cutter 4½ inches. Rigid construction gives free spindle motion and keeps cutter traveling parallel with armature held between centers. Centerless armatures held in V blocks. Distance between centers, 18 inches. Centers will swing armature 9 inches diameter; **Weight**—60 lbs. (shipping); **List Price**—$45.00 including 6 cutters; No. 953C saw type cutters, assorted, $3.50 per doz.

Armature Stand
Catalog No. 987

Trade Name—"Weidenhoff"; **Use**—For holding armature for inspection and repairs (18 in. between centers); **Weight**—20 lbs. (shipping); **List Price**—$4.50.



Lathe
Catalog No. 956

Trade Name—"Weidenhoff"; **Use**—For turning commutators, recentering and turning shafts, turning bushings and bearings, checking shafts for alignment, etc.; **Description**—Lathe swing 7 inches over bed; 18 inches between centers. Cross slide is "V" gibbed and has 4 inch compound travel; **Weight**—100 lbs.; **List Price**—$65.00 includes countershaft, cross slide, 1 face plate, 2 centers, 1 tool bit and 1 lathe dog; No. 962 undercutter for attaching to No. 956 lathe, $35.00; extra lathe equipment available at additional cost.

Wire Stripper Co.,

508 Erie Bldg., Cleveland, Ohio

Wire Stripper

Trade Name—"Speedcraft"; **Use**—For removing insulation from the ends of insulated wire; **Description**—Equipped with 110 volt 60 cycle A.C. motor with ball bearings; adjustable butt rod gives the desired length of strip and as the insulation is removed the wire is polished; insulation removed and loose strands twisted together in one operation; rotary steel knives used; operated by foot pedal; push bottom switch; up to 2000 ends stripped per hour; **Dimensions**—14 x 8 x 7½ in. high; **Weight**—58 lbs. (shipping); **List Price**—$115.00 including extension cord and plug; $7.00 additional for other than above mentioned motor; new knives at a low cost.

Index of Raw Materials, Parts, Electrical Equipment

For all electrical products including electrically operated machines and appliances

Trade Names—Manufacturers' Names—Local Addresses

The names of all manufacturers are grouped alphabetically under the heading for the product they manufacture. Trade names also appear in alphabetical position under the subject identifying the product. Thus "Linolac" insulating varnish will be found in alphabetical position under the heading "Paint, Varnish, Lacquer."

Note: The Classified Index of **ELECTRICAL MANUFACTURING** is limited to those subjects of interest to the specific field which it covers, for obvious reasons. A complete Classified Index of all electrical commodities bought, sold, or used by Electrical Supply Jobbers, Contractors, Dealers, Central Stations and other electrical industry outlets appears regularly in each issue of **ELECTRICAL RECORD** as heretofore. This Classified Index has been an exclusive **ELECTRICAL RECORD** feature for over thirty-six years.

ALUMINUM
(Also Aluminum Bronze Powder.)
Albron, Alcoa, Alumac. See Aluminum Co. of America.
Aluminum Co. of America, 2444 Oliver Bldg., Pittsburgh.
AMMETERS. See Instruments.
ARMATURE
Balancers. See Balancers, Armature.
Banding Machines. See Banding Machines, Armature
Bearings. See Bearings.
Buggies. See Lifts, Armature.
Coil Presses. See Presses, Armature Coil.
Coils. See Coils, Finished.
Core Punchings. See Discs, Armature.
Cranes. See Lifts, Armature.
Discs. See Discs, Armature.
Driers. See Ovens.
Growlers. See Testers, Coil.
Hoists. See Lifts, Armature.
Impregnators, Vacuum. See Ovens, Industrial.
Jacks. See Lifts, Armature.
Laminations. See Discs, Armature.
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New. See Coils, Finished.
Notching Machines. See Notching Machines, Armature.
Pegs. See Pegs, Armature.
Pinion Pullers. See Pullers, Armature Shaft.
Repaired. See Repairing and Second-Hand.
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Shaft Straighteners. See Straighteners, Armature Shaft.
Stands. See Stands, Armature.
Test Benches. See Test Benches, Armature.
Testers. See Testers, Coil; also Test Benches, Armature.
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Trouble Shooters. See Testers, Coil; also Test Benches, Armature.
Trucks. See Lifts, Armature.
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Winding Machines. See Winding Machines, Armature & Field Coil.
Winding Twine. See Twine, Armature.
ARMATURE & COIL SPRAY GUNS. See Spraying Outfits.
ARMORING MACHINES. See Wire Manufacturing Machines.
ARMS, FLEXIBLE. See Tubing Flexible Metallic.
ASBESTOS Shades. See Shades, Fabric.
Paper & Sheet. See Asbestos.
Slabs. See Asbestos Slabs.
Tape. See Tape, Asbestos.
Wire. See Wire, Insulated.
Yarn and Thread. See Yarn and Thread.

ASBESTOS
Sheet, Paper, Mill Board, Lumber.
Asbestos, Shingle, Slate & Sheathing Co., Ambler, Pa.
Easco. See Eastern Asbestos Co.
Eastern Asbestos Co., Providence, R. I.
Ferodo & Asbestos, Inc., New Brunswick, N. J.
Johns-Manville Corp. (Elec'l Dept.) New York, N. Y.

ASBESTOS SLABS
Slabs & Barriers for Switchboard.
Asbestos-Ebony. See Johns-Manville, Inc.
Decelceo, Inc., Wayne, Mich.
Federal Insulating Corp., Yonkers, N. Y.
Johns-Manville Corp. (Elec'l Dept.), New York, N. Y.
Transite. See Johns-Manville, Inc.
Zellite. See Decelceo, Inc.

BAGS, Vacuum Cleaner
Merrimack Mfg. Co., Boston, Mass.

BALANCERS, Armature
(Dynamic Balancing Machines—Balancing Ways).
Anderson Bros. Mfg. Co., Rockford, Ill. (Ways).
Armature Coil Equip. Co., 2415 Forestdale Ave., Cleveland, O. (Machine).
Bowsher Co., N. P., South Bend, Ind.
Olsen Testing Machine Co., Tinius, 500 N. 12th St., Philadelphia, Pa. (Machines).
Sundstrand Machine Tool Co., Rockford, Ill.
Vibration Specialty Co., 1534 Winter, Philadelphia, Pa. (Machines).

BALL BEARINGS. See Bearings, Ball and Roller.

BANDING MACHINES, Armature
Columbia Machine Wks. & Malleable Iron Co., Atlantic Ave. & Chestnut St., Brooklyn, N. Y.
Electric Service Supplies Co., 17th & Cambria Sts., Philadelphia, Pa.
Peerless. See Electric Service Supplies Co.
Ridlon Company, Frank, Boston, Mass.

BARRIERS, Switchboard. See Slate; also Soapstone; also Asbestos.

BARS, BUS. See Brass, Bronze & Copper; also Aluminum.

BARS, Commutator
American Brass Co., 25 Broadway, New York, N. Y.
Anaconda. See American Brass Co.
Buckeye Tempered Copper & Brass Co., Mansfield, O.
Cameron Electric Mfg. Co., Ansonia, Conn.
Commutator Co., 121 N. Front, Minneapolis, Minn.
Eureka Copper Products Corp., North East, Pa.
Homer Commutator Co., 4743 Hough Ave., N. E., Cleveland.
Rome Brass & Copper Co., Rome, N. Y.

BASES, Radio Tube. See Radio Molded Parts.

BASES, Reading Lamp
Metal, Pottery, Wood & Glass.
American Ring Co., Waterbury, Conn.
Aladdin Mfg. Co., Sales Div. No. 802, Muncie, Ind.
Armor Bronze Co., Garwood, N. J.
Camden Art Tile & Pottery Co., Camden, Ark.
Colonial. See Old Colony Iron Wks.

Estes & Sons, E. B., 5844 Grand Central Terminal, New
Fulper Pottery Co., Flemington, N. J.
Globe Metal Spinning Co., 178 Centre, New York, N. Y.
Hemill Products, Inc., 103 Mott, New York, N. Y.
Insulation Mfg. Co., New York Ave. and Herkimer St., Brooklyn, N. Y.
Marbleart. See Insulation Mfg. Co.
Natural. See Insulation Mfg. Co.
Old Colony Iron Wks., Bridgeport, Conn.
Pittsburgh Valve & Fittings Co., Barberton, Ohio. (Cast Iron.)
Rodale Mfg. Co., 200 Hudson, New York, N. Y.
Sneath Glass Co., Hartford City, Ind.
Van Briggle Tile & Pottery Co., Colorado Springs, Colo.
Weller, S. A., Zanesville, O. (Pottery.)
Yokel Corp., 219 Homestead Ave., Hartford, Conn.
Zane Pottery Co., South Zanesville, O.
BATTERY CHEMICALS. See Chemicals, Battery.
BATTERY CUT OUTS. See Switches, Battery.
BATTERY GAGES. See Instruments, Pocket.
BATTERY JARS. See Jars, Battery, Glass; also Rubber; also Molded Insulation.
BATTERY OXIDES. See Chemicals, Battery.
BATTERY SALTS. See Chemicals, Battery.
BEAD CHAIN. See Chain, Socket.
BEADS, Chandelier. See Crystals, Chandelier.

BEADS, Insulating
American Lava Corp., 1425 William, Chattanooga, Tenn.
Dunco. See Struthers Dunn, Inc.
Martindale Elec. Co., 1262 W. Fourth, Cleveland, O.
Struthers Dunn, Inc., 1135 Race, Philadelphia, Pa.

BEARINGS
Ball & Roller. See Bearings, Ball & Roller.
Graphite. See Bearings, Oil-less.
Oil-less. See Bearings, Oil-less.
Sleeve. See Bearings & Bushings.

BEARINGS, Ball and Roller
Ahlberg Bearing Co., 317 E. 29th, Chicago, Ill.
Bantam Ball Bearing Co., South Bend, Ind.
Braun Bearings Co., Primos, Pa.
Commercial. See Schatz Mfg. Co.
C J B. See Ahlberg Bearing Co.
Fafnir Bearing Co., New Britain, Conn.
Federal Bearing Co., Poughkeepsie, N. Y.
Gurney. See Marlin-Rockwell Corp.
Hyatt Roller Bearing Co., Newark, N. J.
Hoffman. See Norma-Hoffman Bearings Corp.
McGill Metal Co., Valparaiso, Ind.
Marlin-Rockwell Corp., Jamestown, N. Y.
Mathews Mfg. Co., 104 Gold, Worcester, Mass.
New Departure Mfg. Co., Bristol, Conn.
Nice Ball Bearing Co. (Nicetown), Philadelphia, Pa.
Norma-Hoffman Bearings Corp., Stamford, Conn.
Roller Bearing Co. of America, Whitehead Rd., Trenton, N. J.
Schatz Mfg. Co., Poughkeepsie, N. Y.
Schubert. See McGill Metal Co.
Standard Steel & Bearings, Inc., Plainville, Conn.
Strom Bearings Co., 4587 Palmer, Chicago, Ill.
S. K. F. Industries, 40 E. 34th, New York, N. Y.
Timken Roller Bearing Co., Canton, O.
Torrington Co., Torrington, Conn.

BEARINGS, Oil-Less
Argute Oilless Bearings Co., 149 Berkeley, Philadelphia, Pa.
B. M. C. See Burlington Metal Corp.
Bogert & Hopper, Inc., 225 Varick, New York, N. Y.
Bound Brook Oil-less Bearing Co., Bound Brook, N. J.
Burlington Metal Corp., Burlington, Wis.
Cleveland Graphite Bronze Co., 880 E. 72nd, Cleveland, O.
Electric Railway Equipment Co., 30 Church, New York, N. Y.
Elreco. See Electric Railway Equipment Co.
Graphalloy. See Graphite Metallizing Co.
Graphite Metallizing Co., Yonkers, N. Y.
Lubrite. See Merriam Bros., Yonkers, N. Y.
Merriam Bros., 185 Amory, Boston, Mass.
Metal Saw & Machine Co., Springfield, Mass.
Neveroil Bearing Co., Wakefield, Mass.
Nolu Oilless Bearing Co., 6 E. Johnson, Philadelphia, Pa.
O. & S. Bearing Co., 315 S. Artillery, Detroit, Mich.
Reliance. See Metal Saw & Machine Co.
Seib Lignum-Vitae Woodturning Co., 98 Boyd Ave., Jersey City, N. J.
United States Graphite Bearing Co., Saginaw, Mich.

BEARINGS AND BUSHINGS
(For Armature Shafts.)
Ajax Metal Co., Philadelphia, Pa.
American Bronze Corp., Berwyn, Pa.
Bunting Brass & Bronze Co., Toledo, Ohio.
Damascus Bronze Co., Pittsburgh, Pa.
Flood City Mfg. Co., Johnstown, Pa.
Johnson Bronze Co., New Castle, Pa.
Lumen Bearing Co., Buffalo, N. Y.
National Bearing Metal Corp. (More-Jones Brass & Metal Div.), 4930 Manchester Ave., St. Louis, Mo.
United States Graphite Co., Saginaw, Mich.
BELTING, Chain Transmission. See Chain, Power Transmission.

BELTS, Rubber
Molded Cord Rubber Belts for Electrical Appliances.
Fay Rubber Products Co., Elyria, O.
Gilmer Co., L. H. (Tacony), Philadelphia, Pa.

BENDERS, Coil Loop
Armature Coil Equipment Co., 2415 Forestdale Ave., Cleveland, Ohio.
Electric Service Supplies Co., 17th & Cambria Sts., Philadelphia, Pa.
Segur. See Electric Service Supplies Co.
BENDING. See Punching & Bending.
BINDING POSTS. See Posts, Binding.

BLADES, Fan
Estes & Sons, E. B., 5844 Grand Central Terminal Bldg., New York, N. Y.
Spee-Dee Elec. Mfg. Co., 199 Lafayette, New York, N. Y.
Torrington Mfg. Co., Torrington, Conn.
BLUESTONE. See Chemicals, Battery.
BOARD, Fuller. See Cloth and Paper.
BOARD, Press. See Cloth and Paper.
BOWL HOLDERS. See Fixture Fittings.

BOX BOARD
Container Corp. of America, Dept. 36, 111 W. Washington, Chicago, Ill.
Mid-West Box Co., Dept. 36, 111 W. Washington, Chicago.

BOXES, Fibre
Container Corp. of America, Dept. 36, 111 W. Washington, Chicago, Ill.
Corrfibre. See Container Corp. of America.
Mid-West Box Co., Dept. 36, 111 W. Washington, Chicago.
BOXES, Sheet Steel. See Cabinets, Sheet Steel.
BOXES, Wood. See Cabinets & Boxes, Wood.

BOXES AND WRAPPERS
Brown & Bailey Co., Front & Willow Sts., Philadelphia, Pa.
Bulldog. See Pittsburgh Corrugated Paper Box Co.
Campbell Paper Box Co., South Bend, Ind.
Consolidated Paper Co., Monroe, Mich.
Container Corp. of America, Dept. 36, 111 W. Washington, Chicago, Ill.
Gair Co., Robert, 420 Lexington Ave., New York. (Boxes.)
Gator-Hide Kraft. See International Paper Co.
Hinde & Dauch Paper Co., 304 Decatur, Sandusky, Ohio.
International Paper Co., 100 E. 42nd, New York, N. Y.
Lake Lithographing Co., 2570 Superior Ave., Cleveland, O. (Display Cartons.)
Mid-West Box Co., 111 W. Washington, Dept. 36, Chicago.
National Folding Box Co., New Haven, Conn. (Cartons.)
Pittsburgh Corrugated Paper Box Co., Pittsburgh, Pa.
River Raisin Paper Co., Monroe, Mich.
Sefton Mfg. Co., 59 E. Madison, Chicago, Ill.
Shuttleworth Carton Co., 474 W. Broadway, New York.
Thompson & Norris Co., 213 Concord, Brooklyn, N. Y.
BRAIDING MACHINES. See Wire Manufacturing Machines.
BRASS TUBING. See Tubing, Brass and Copper.

BRASS, BRONZE AND COPPER
Sheet, Rod, Bar.
American Brass Co., 25 Broadway, New York, N. Y.
Anaconda. See American Brass Co.
Baltimore Brass Co., 1212 Wicomico, Baltimore, Md.
Baltimore Copper Mills, (Div. of General Cable Corp.), Baltimore, Md.
Bridgeport Brass Co., 774 E. Main, Bridgeport, Conn.
Dallas Brass & Copper Co., 812 Orleans, Chicago, Ill.
Plume & Atwood Mfg. Co., 474 Bank, Waterbury, Conn.
Scovill Mfg. Co., Waterbury, Conn.
Seymour Mfg. Co., Seymour, Conn.
Titan Metal Mfg. Co., Bellefonte, Pa. (Rods and Forgings.)
BREAKERS, Circuit. See Circuit Breakers.
BRIDGES, Wheatstone. See Instruments, Laboratory Standard.
BRONZE. See Brass, Bronze and Copper; also Castings.
BRONZE, Phosphor. See Phosphor Bronze.
BRONZE POWDER, Aluminum. See Aluminum.
BRUSH HOLDERS. See Brushes, Commutator.
BRUSHES, Carbon. See Brushes, Commutator.
Graphite. See Brushes, Commutator.
Metal Graphite. See Brushes, Commutator.

BRUSHES, COMMUTATOR
(Brushes, Brush Holders and Flexible Leads.)

Brush Holders	See H									
Carbon, Graphite, Metal Graphite	See C									
Flexible Leads and Pig Tails	See L									
Sheet Metal	See S									
Wire Gauze	See W									
Automotive Mfg. Co., Kansas City, Mo.									H	
B. B. B. See Becker Bros. Elec'l Corp.										
Baylis Co., Bloomfield, N. J.									H	
Becker Bros. Elec. Corp., 23 N. Jefferson, Chicago, Ill.							C	W	S	H L
Blanck & Carrier Corp., 115 W. 63rd, New York, N. Y.							C			
Boston Woven Wire Brush Co., Northboro, Mass.								W		
Bozill-Bruel Carbon Co., Columbus Park, O.							C			H
Burrows & Co., 1135 W. Van Buren, Chicago, Ill.							C			
Calebaugh Self-Lubricating Carbon Co., 1503 Columbia Ave., Philadelphia, Pa.							C			
Carbon Engrg. Co., Slinger, Wis.							C			L
Carbon Laboratories Co., 5005 Euclid Ave., Cleveland, O.							C			
Carbon & Graphite Products Co., 227 West Broadway, New York, N. Y.							C			
Carence. See Carbon Engineering Co.										
Chapin Co., Chas. E., 227 Fulton St., New York, N. Y.							C	W	S	L
Columbia Machine Wks. & M. I. Co., 263 Chestnut, Brooklyn, N. Y.									H	
Cooley Mfg. Co., 98 Park Place, New York								W		
Diamond C. See Chapin Co., Chas. E.										
Dixon Crucible Co., Joseph, Jersey City										
Electra. See Automotive Mfg. Co.										
Electric Accessories Co., 310 York Ave., Philadelphia, Pa.									H	
Electro-Nite Carbon Co., 308 N. Fourth, Philadelphia, Pa.										
Eureka Copper Products Corp., North East, Pa.								W	S	H
Fleck Carbon Co., 508 Broome, New York							C			

BRUSHES, Commutator—Continued
General Electric Co., Schenectady, N. Y.... C . . . H
Graphalloy. See Graphite Metallizing Corp.
Graphite Metallizing Corp., 1040 Nepperhan Ave., Yonkers, N. Y. C . . . H
Henrite Products Co., 98 Park Place, New York, N. Y. C . . . . . .
Holland Trolley Supply Co., 1623 E. 43rd, Cleveland, Ohio . . . . H
Jeandron, W. J., 345 Madison Ave., New York, N. Y. (Imported.) C . . . . .
Keystone Carbon Co., 4630 N. 11th, Philadelphia, Pa. C . . . . . .
Kohlenite Products Co., 417 W. 28th, New York, N. Y. C . . . . . .
Le Carbone. See Jeandron, W. J.
Le Valley Vitae Carbon Brush Co., 3603 Grand Central Terminal, New York, N. Y. C . . . . . .
Marks Elec. Co., Hiram, 304 Woodward Ave., Detroit, Mich. C . . . . . .
Morganite Brush Co., 33-02 48th Ave., Long Island City, N. Y. C . . . . . .
National Carbon Co., Cleveland, O. C . . . . . .
New Process Carbon Co., 1503 Columbia Ave., Philadelphia, Pa. C L
No Spark. See Calebaugh Self-Lubricating.
Ohio Carbon Co., 8215 Almira Ave., Cleveland, Ohio C W . . . L
Ohio Elec. Specialty Mfg. Co., Troy, O. . . W . . . .
Perfection Supply Co., 98 Park Pl., New York, N. Y. C W S H L
Pittsburgh Carbon Brush Co., 127 Fancourt, Pittsburgh, Pa. C . . . . . .
Pure Carbon Co., Wellsville, N. Y. C W S . . L
Pyramid. See National Carbon Co.
Reaction. See Baylis Co.
Rome Wire Co., Div. of General Cable Corp., Rome, N. Y. . . W . . . L
Salem Electrical Supply Co., Salem, Mass. . . W . . . .
Seabury, Ralph L., Factories Bldg., Toledo, O. C . . . . . .
Smart & Co., Geo. W., 110 S. Ninth, St. Louis, Mo. C . . . . . .
Speo-Dee Elec. Mfg. Co., 199 Lafayette, New York, N. Y. C L
Speer Carbon Co., St. Mary's, Pa. C . . . . . .
Stackpole Carbon Co., St. Mary's, Pa. C . . . . . .
Sterling. See Carbon Laboratories Co.
Superior Carbon Products Co., North Rd., Poughkeepsie, N. Y. C . . . . . .
U. S. Graphite Co., Saginaw, Mich. C . . . . . .
Unico. See Universal Carbon Co.
Universal Carbon Co., Dundee, Ill. C . . . . . .
Universal. See Graphite Metallizing Corp.
Weber Elec. Wks., Brooklyn Sta., Cleveland. C L

BRUSHES, PNEUMATIC SPRAYING. See Spraying Outfits.

BRUSHES FOR VACUUM CLEANERS

Omaha Brush Co., 320 N. 15th, Omaha, Neb. (Brushes rebristled.)
Osborn Mfg. Co., 5401 Hamilton Ave., Cleveland, Ohio.

BUGGIES, Armature. See Lifts, Armature.

BULBS, Glass

For Incandescent Lamps and Tubes.
Almo Mfg. Co., 38 Crawford, Newark, N. J.
Fayette Glass Bulb Co., 229 21st, Brooklyn, N. Y.
Libby Glass Co., Toledo, O.

BUNCHING MACHINES. See Wire Manufacturing Machines.

BUSHINGS, SHAFT. See Bearings and Bushings.

CABINET GRILL CLOTH. See Cloth, Untreated.

CABINETS, Ice Cream. See Refrigerator Cabinets.

CABINETS, Fibre

Diamond State Fibre Co., Bridgeport, Pa.
Valewood. See Diamond State Fibre Co.

CABINETS, Refrigerator. See Refrigerator Cabinets.

CABINETS, Sheet Steel

Stamped and Turned-up Boxes and Cabinets.
Acme Blow Pipe & Sheet Metal Wks., New Orleans, La.
Adam Electric Co., Frank, St. Louis, Mo.
Aurora Steel Products Co., Aurora, Ill.
Benjamin Elec. Co., 1378 E. 16th, Los Angeles, Cal.
Berks Engineering Co., Reading, Pa.
Berthold Elec. Co., Gus, 555 W. Monroe, Chicago, Ill.
C. & P. Electric Wks., Springfield, Mass.
Cleveland Switchboard Co., 2925 E. 79th, Cleveland, O.
Coast Specialty Co., 72 E. Sixth, Portland, Ore.
Cole Metal Products Co., 33 Crescent, Long Island City.
Columbia Elec. Mfg. Co., 59 Columbus Sq., San Francisco, Cal.
Columbia Metal Box Co., 226 E. 144th, New York, N. Y.
Columbian Steel Tank Co., 1505 W. 12th, Kansas City, Mo.
Commercial Mfg. & Supply Co., 1443 Delaware St., Denver.
Diamond Elec'l Mfg. Co., 1330 E. 16th, Los Angeles, Cal.
Diamond C. See Standard Elec. Supply Co.
Dowman-Dozier Mfg. Co., 1314 Murphy Ave., S. W., Atlanta, Ga.
Electric Box & Switchboard Co., 500 S. Thorp, Chicago.
Electric Panelboard Co., 426 Exchange, Rochester, N. Y.
Electric Apparatus Co., 702 N. Halsted, Chicago, Ill.
Federal Steel Products Co., 2 Ave. L, Newark, N. J. (Polarized Boxes.)
Fouch Elec. Mfg. Co., 105 N. Ninth, Portland, Ore.
Greater New York Metal Box Co., Inc., 143 W. 19th, New York.
Green Elec. Co., 21 N. Water, Rochester, N. Y.
Gurney Sheet Metal Wks., 718 E. 4th, Long Beach, Cal.
Haase, J. B., Driggs Ave. and N. 11th, Brooklyn, N. Y.
Holzer Sheet Metal Wks., Inc., New Orleans, La.
Hough Mfg. Co., 2520 24th, Detroit, Mich.
Isert Co., J. H., 1234 Rowan, Louisville, Ky.
Karp Metal Products Co., 129 30th, Brooklyn, N. Y.
Kirtland Elec. Construction Co., 34 Herkimer, Albany, N. Y.
Large-Dall Mfg. Co., 606 Cherry St., Philadelphia.
Leonard Elec. Mfg. Co., 2907 Perkins Ave., Cleveland, O.
Lexington Elec. Products Co., 419 E. 24th, New York, N. Y.
MacMillen Mfg. Co., 1400 N. Spring, Los Angeles, Cal.
Mansfield Elec. Hardware Co., Longview Ave., Mansfield, O.
Metropolitan Elec. Co., 2914 First Ave., S., Seattle, Wash.
Metropolitan Elec. Products Co., Blvd. at 14th, Long Island City, N. Y.
Milwaukee Vault & Cabinet Co., 521 Market, Milwaukee.
Mosher, S. L., 1951 Lawrence, Denver, Colo.
National Metal Box Co., Van Dyke & Perris Sts., Brooklyn.
Newman Elec. & Mfg. Co., Eau Claire, Wis.
Parr-Metal Products Corp., 3519 41st, Long Island City, N. Y.
Penn Electrical Co., 35 Water, Irwin, Pa.
Powerlite Switchboard Co., 4149 E. 79th, Cleveland, O.
Rezioh. See Holzer Sheet Metal Works.
Robbins & Myers, Inc., Springfield, O.
Security. See Aurora Steel Products Co.
Standard Elec. Supply Co., 223 N. 13th, Philadelphia, Pa.
Standard Metal Box Corp., 950 Grand St., Brooklyn, N. Y.
Star Metal Box Co., 258 46th, Brooklyn, N. Y.
States Elec. Mfg. Co., 703 Plymouth Ave., N., Minneapolis.
Superior Switchboard & Devices Co., 420 Schroyer Ave., Canton, O.
Tanner & Co., Wm. F., 511 S. Sharp, Baltimore, Md.
United Metal Box Co., 473 President, Brooklyn, N. Y.
United Sheet Metal Wks., 575 Howard, San Francisco.
Universal Metal Box & Products Co., 316 Coit, Irvington.
Wadsworth Elec. Mfg. Co., Covington, Ky.
Wurdack Elec. Mfg. Co., 4444 Clayton Ave., St. Louis, Mo.

Die Castings

Aluminum, Tin, Lead and White Brass, Special Machines, Dies, Tools, Jigs and Stampings

Advance Tool & Die Casting Co.
1654-60 Holton St., Milwaukee, Wis.
Edgewood 284

CABINETS AND BOXES, Wood

Ampere. See Donehue Lumber Co.
Aston Cabinet Mfrs., 1323 W. Lake, Chicago, Ill.
Boehm Cabinet Co., J., 2216 W. 63rd St., Cleveland, O.
Buckeye. See Studner Bros.
Carolina Wood Products Co., Asheville, N. C.
Carron Co., Ludington, Mich.
Caswell-Runyon Co., Huntington, Ind.
Cheney Piano Action Co., A. C., Castleton, N. Y.
Clinton Corp., 342 Madison Ave., New York, N. Y.
Corlieth Cabinet Mfg. Co., St. Mary's, Pa.
Cory Cabinet Corp., Springfield, Mo.
Dekker Co., Geo., Henderson, Ky.
Donehue Lumber Co., Smith and State, Perth Amboy, N. J.
Efkeln & Sons, Frederick, 44 Central Ave., Brooklyn, N. Y.
Empire-United Hat Block Co., 312 E. 22nd, New York.
Estes & Sons, E. B., 5344 Grand Central Terminal Bldg., New York, N. Y.
Excello Products Corp., 4836 W. 16th, Cicero, Ill.
Grand Rapids Furniture Co., Grand Rapids, Mich.
Harper Mfg. Co., Cassopolis, Mich.
Hickory Box Co., Hickory, N. C.
Interstate Woodworking Co., 46 Wooster, New York, N. Y.
Karpen. See Studner Bros.
King Mfg. Corp., Bano & Crowley, Buffalo, N. Y.
Klumpp Sons, John G., 13 Baxter, New York, N. Y.
National Cabinet Co., New Philadelphia, O.
Natural Voice Talking Mach. & Radio Cabinet Co., Oneida, N. Y.
New England Box Co., Greenfield, Mass.
Ottawa Furniture Co., Holland, Mich.
Parker-Young Co., 131 State, Boston, Mass.
Pierson Co., 836 Cedar, Rockford, Ill.
Pooley Co., 16th & Indiana Ave., Philadelphia, Pa.
Radio Allied Mfrs. Corp., 1340 S. Michigan Ave., Chicago.
Radio Cabinet & Equipment Co., 1504 Vine, Philadelphia.
Radio Mfg. Co., Div. of Pillied Lumber Co., Swanton, O.
Radio Master Corp. of America, Bay City, Mich.
Red Lion Cabinet Co., Red Lion, Pa.
R. E. Z. Cabinet Co., 54 North, Boston, Mass.
Rockford Sales Corp., 208 Lexington Ave., New York, N. Y.
Schutz Bros., 152 Chambers, New York, N. Y.
Southern Toy Co., Hickory, N. C.
Specialty Display Case Co., Kendallville, Ind.
Stradivara Co., Coshocton, Ohio.
Straus Cabinet Wks., Eugene, Baxter Ave., Louisville, Ky.
Stettner Phonograph Corp., 318 E. 75th, New York.
Studner Bros., 67 W. 44th, New York, N. Y.
Superior Cabinet Corp., 206 Broadway, New York, N. Y.
Syracuse Screen & Grille Co., North Manchester, Ind.
Tessier Bros., 355 Bridge, Northampton, Mass. (Radio.)
Trenton Wood Specialty Co., Stokes Ave. and P. R. R., Trenton, N. J.
Udell Wks., 28th and Barnes Ave., Indianapolis, Ind.
West Box Co., 235 Liberty, Springfield, Mass.

CABLE ARMORING MACHINES. See Wire Manufacturing Machines.

CABLE TEST SETS. See Instruments, Portable and Switchboard.

CABLING MACHINES. See Wire Manufacturing Machines.

CANDLES, Fixture

Glass, Fibre Paper.
Brandywine Fibre Products Co., 1402 Walnut, Wilmington.
Cleveland Container Co., 10800 Berea Rd., Cleveland, O.
Fibro Products Co., New Bedford, Mass.
Phoenix Glass Co., 230 5th Ave., New York, N. Y.
Remington Mfg. Co., 939 Barnum Ave., Bridgeport, Conn.
Seamless. See Fibro Products Co.

CANOPY (Canopies). See Fixture Fittings.
Insulators. See Insulators.
Switches. See Switches, Snap.

CAPACITORS, RADIO. See Radio Circuit Components.

CARBON, Powdered

Marks Elec. Co., Hiram, 304 Woodward Ave., Detroit, Mich.

CARBONS, Battery. See Carbons.
Arc Light. See Carbons.

CARBONS

Battery Arc Light.
Blanck & Carrier Corp., 115 W. 63rd, New York, N. Y.
Columbia. See National Carbon Co.
Daylight. See National Carbon Co.
Lessing Battery. See Blanck & Carrier Corp.
Nuernberg Battery. See Blanck & Carrier Corp.
National Carbon Co., Cleveland, Ohio.
Oretip. See National Carbon Co.
Silvertip. See National Carbon Co.
Speer Carbon Co., St. Mary's, Pa.
Stackpole Carbon Co., St. Mary's, Pa.

CARTONS. See Boxes and Wrappers.

CASES, Eliminator. See Cases, Eliminator.
Flashlight. See Cases, Flashlight.

CASES, Elminator

Luna Tin Mfg. Co., 547 W. 21st, New York, N. Y.

CASES, Flashlight

Bridgeport Brass Co., 744 E. Main, Bridgeport, Conn.
Lincoln Fibre Specialty Co., Newport, Del.
St. Louis Paper Can & Tube Co., St. Louis, Mo.
Underwood Battery Co., 1250 Ontario, Cleveland, O.

CASTINGS, Aluminum. See Castings, Aluminum. Also
Castings, Copper, etc.
Brass. See Castings.
Bronze. See Castings.
Copper. See Castings.
Die. See Castings, Die.
Monel Metal. See Castings.
Steel. See Castings, Steel.
White Metal. See Castings.

CASTINGS, Aluminum

Aluminum Co. of America, 2471 Oliver Bldg., Pittsburgh.
Quality Aluminum Casting Co., Waukesha, Wis.

CASTINGS

Copper, Brass, Bronze, Monel Metal, White Metal.
Anderson Mfg. Co., Albert & J. M., 289 A, Boston, Mass.
Bohn Aluminum & Brass Corp., 2512 E. Grand Blvd., Detroit.
Central Pattern & Foundry Co., 3737 S. Sacramento Ave., Chicago, Ill.
Chase Brass & Copper Co., Waterbury, Conn.
Faries Mfg. Co., Decatur, Ill.
McGill Metal Co., Valparaiso, Ind.
Ohio Pattern Wks. & Fdy. Co., 2730 Spring Grove Ave., Cincinnati, O.
Sterling Art Metal Wks., 40 Purvis, Long Island City, N. Y.
Twin City Die Castings Co., Talmadge and 33rd Ave., Minneapolis, Minn. (White Metal).

CASTINGS, Die

Advance Tool & Die Casting Co., 1654 Holton, Milwaukee, Wis.
Alemite Die-Casting & Mfg. Co., 2640 Belmont Ave., Chicago, Ill.
Allied Die-Casting Corp., Long Island City, N. Y.
Alumac. See Aluminum Co. of America.
Aluminum Co. of America, 2471 Oliver Bldg., Pittsburgh.
Aluminum Industries, Inc., 2438 Beekman, Cincinnati, O.
American Die Casting Co., 2040 Dominick, Chicago, Ill.
Badger Die Casting Co., 155 Buffalo, Milwaukee, Wis.
Barnhardt Bros. & Spindler, Monroe & Thropp St., Chicago.
Do-Di. See Doehler Die Casting Co.
Doehler Die Casting Co., 356 Fourth Ave., New York, N. Y.
Franklin Die Casting Corp., Syracuse, N. Y.
Illinois Die Casting Co., 551 W. Congress, Chicago, Ill.
Milwaukee Die Casting Co., 239 Fourth, Milwaukee, Wis.
Newton Die Casting Corp., New Haven, Conn.
Perfection Die Casting Corp., 406 Lakeside Ave., N. W., Cleveland, O.
Permite. See Aluminum Industries, Inc.
Stewart Die Casting Co., 4500 Fullerton Ave., Chicago, Ill.
Superior Die Casting Co., 875 E. 70th, Cleveland, Ohio.

CASTINGS, Gray Iron

American Engineering Co., Philadelphia, Pa.
Athens Foundry Co., Athens, Pa.
Barlow Foundry Co., 551 N. J. R. R. Ave., Newark, N. J.
Barnett Foundry Co., Newark, N. J.
North Wales Mach. Foundry Co., North Wales, Pa.
Snead & Co., Pine St., Jersey City, N. J.
Sacks Iron Foundry, L., 357 Wilson Ave., Newark, N. J.
St. Louis Malleable Castings Co., 7701 N. Conduit Ave., St. Louis, Mo.

CASTINGS, Steel

Bonney-Floyd Co., Columbus, Ohio.
Eastern Steel Casting Co., Ave. L & Edward St., Newark.
Pittsburgh Malleable Iron Co., Pittsburgh, Pa.
Riverside Steel Casting Co., Jacobus Ave., Kearney, N. J.

CEMENT, Commutator

Armstrong. See Electric Power Maintenance Co.
Conductalute. See Technical Products Co.
Early, Edward E., 1129 W. Fifth, N. W., Canton, O.
Electric Power Maintenance Co., 21 N. Third, Minneapolis.
Imperial. See Martindale Electric Co.
Martindale Electric Co., 1262 W. Fourth, Cleveland, O.
Mitchell Rand Mfg. Co., 19 Vesey, New York, N. Y.
Perce-Lute. See Perfection Supply Co.
Perfection Supply Co., 98 Park Pl., New York, N. Y.
Pisa Mica Co., 26 St. Andrews Place, Yonkers, N. Y.
Technical Products Co., 114 S. Sheridan Sq., Pittsburgh, Pa.
Westinghouse Elec. & Mfg. Co., East Pittsburgh, Pa.

CEMENT, Liquid Porcelain

Anchorlute. See Technical Products Co.
Fire Lute. See Technical Products Co.
Insa-Lute. See Technical Products Co.
Okonite Co., Passaic, N. J.
Repairet Mfg. Co., Milwaukee, Wis.
Technical Products Co., 114 S. Sheridan Sq., Pittsburgh, Pa.
Thermold. See Technical Products Co.

CHAIN, Chandelier (Fancy). See Crystals, Chandelier.

CHAIN DRIVES. See Chain, Power Transmission.

CHAIN, Fixture

Acco. See American Chain Co.
American Chain Co., Bridgeport, Conn.
Chase Brass & Copper Co.
Eastern Chain Works, 309 E. 22nd St., New York, N. Y.
Faries Mfg. Co., Decatur, Ill.
Globe Metal Mfg. Co., 2122 E. Hazard, Philadelphia, Pa.
H. & O. Chain Co., So. Norwalk, Conn.
Leviton Mfg. Co., 226 Newell, Brooklyn, N. Y.
Newark Metal Mfg. Co., 22 S. 6th, Newark, N. J.
Plume & Atwood Mfg. Co., Waterbury, Conn.
Rodale Mfg. Co., 200 Hudson, New York, N. Y.
Steele & Johnson Mfg. Co., Waterbury, Conn.
Universal Metal Chain Co., 75 Clymer, Brooklyn, N. Y.

CHAIN, Power Transmission

American High Speed Chain Co., 221 E. South, Indianapolis.
Baldwin Chain & Mfg. Co., Worcester, Mass.
Boston Gear Wks. Sales Co., Norfolk Downs, Mass.
Diamond Chain & Mfg. Co., Indianapolis, Ind.
Link-Belt Company, Chicago, Ill.
Morse Chain Co., Ithaca, N. Y.
Ramsey Chain Co., Inc., Albany, N. Y.
Reeves Pulley Co., Columbus, Ind.
Renold Boston. See Boston Gear Wks.
Whitney Mfg. Co., Hartford, Conn.

CHAIN, Socket

American Ball Chain Works, 12 Wooster St., New York.
Bead Chain Mfg. Co., Bridgeport, Conn.
H. & O. Chain Co., South Norwalk, Conn.

CHANDELIER BEADS. See Crystals, Chandelier.

CHANDELIER CRYSTALS. See Crystals, Chandelier.

CHANDELIER FRINGE. See Crystals, Chandelier.

CHARGERS, Magnet

Charging, Remagnetizing.
Colpin Corp., 6110 S. Main, Los Angeles, Cal.
Cowie Elec. Co., E. S., 1823 Wyandotte, Kansas City, Mo.
Fore Elec. Mfg. Co., 5255 Wabada Ave., St. Louis, Mo.
Serwell Sales Corp., 1749 N. Winchester Ave., Chicago.
Valley Electric Co., 4221 Forest Park Blvd., St. Louis, Mo.

CHEMICALS, Battery

Electrolyte, Battery Salts, Battery Oxides, Sal Ammoniac, Bluestone, Manganese.
Cooper & Co., Charles, 194 Worth, New York, N. Y.
Eagle-Picher Lead Co., 134 LaSalle, Chicago. (Oxide.)
Elmer & Amend, 205 3rd Ave., New York, N. Y.
Electro Chemical Co., 113 W. Court St., Dayton, O.
General Metallic Oxides Co., Jersey City, N. J.
Globe Chemical Co., Murray Rd. and Big Four R. R., Cincinnati, O.
Grasselli Chemical Co., Guardian Bldg., Cleveland, O.
Kalbfleisch Corp., 200 5th Ave., New York, N. Y.
Klipstein Co., 644 Greenwich, New York, N. Y.
Merrimac Chemical Co., 148 State, Boston, Mass.
New Jersey Zinc Co., 160 Front, New York, N. Y. (Zinc Chloride.)
Powers-Weightman-Rosengarten Co., Philadelphia, Pa.
Voltah. See Powers-Weightman-Rosengarten Co.
Wah Chang Trading Corp., 232 Broadway, New York, N. Y.

CHEMICALS, Refrigeration

Ansul Chemical Co., Marinette, Wis.
Arctic. See Roessler & Hasslacher Chemical Co.
Carbide & Carbon Chemicals Corp., 30 E. 42nd, New York, N. Y. (Butane & Isobutane.)
Dry Ice Corp. of America, 50 E. 42nd, New York, N. Y.
Roessler & Hasslacher Chemical Co., 709 Sixth Ave., New York, N. Y. (Methyl Chloride, Ethyl Chloride.)
Virginia Smelting Co., West Norfolk, Va. (Sulphur Dioxide.)
Chromium Plating. See Plating & Finishing.

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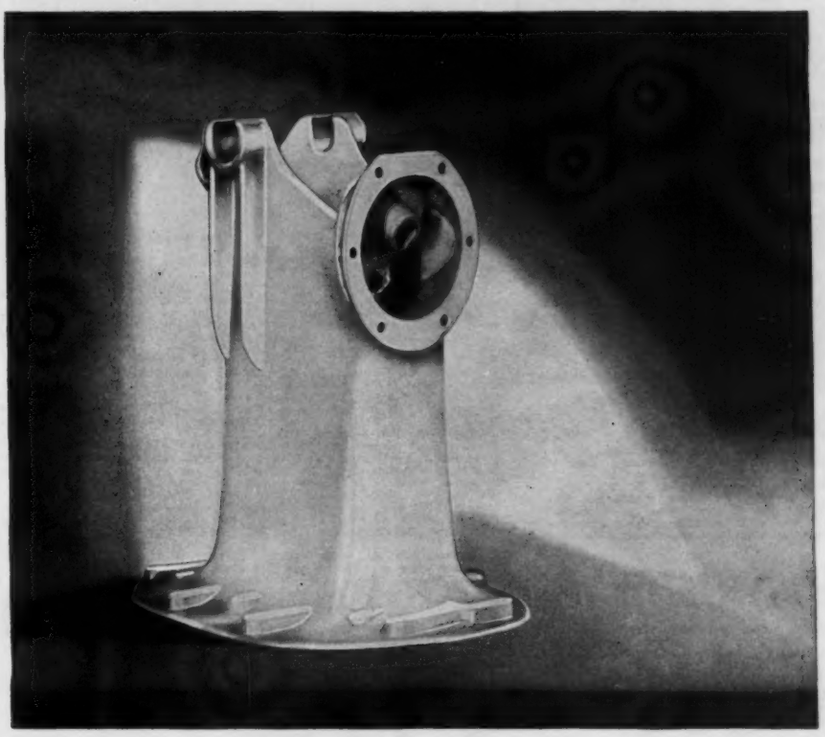

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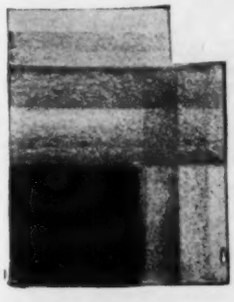

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For Strength, Lightness, Economy

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Made in large quantities on special machines. Manufacturers buy from us for less than it would cost them to make their own contacts. Shall we mail samples and prices to you?

CONTRACT WORK—Let us manufacture your product and serve as your factory. Write us.

GRAY BROTHERS, Inc., Plano, Ill.

CHUCKS, Magnetic
Simmons. See Taft-Pierce Mfg. Co.
Taft-Peirce Mfg. Co., Woonsocket, R. I.
Walker Co., O. S. (Rockdale). Worcester, Mass.

CIRCUIT BREAKERS
Air and Oil Circuit Breakers and Oil Break Switches.
Allen-Bradley Co., 493 Clinton, Milwaukee, Wis.
Anderson Mfg Co., Albert & J. M., 289 A, Boston, Mass.
Automatic Reclosing Circuit Breaker Co., Columbus, O.
Automatic Switch Co., 517 E. Larned, Detroit, Mich.
Burke Controller Co., 369 Lexington Ave., New York, N. Y.
Condit Elec'l Mfg. Corp., 838 Summer St. (South Boston), Boston, Mass.
Cramblet Engineering Corp., 286 Milwaukee, Milwaukee.
Cutler-Hammer Mfg. Co., 1288 St. Paul Ave., Milwaukee.
General Electric Co., Merchandise Dept., Bridgeport, Conn.
Inducto-therm. See Allen-Bradley Co.
I. T. E. Circuit Breaker Co., 19th and Hamilton Sts., Philadelphia, Pa.
Line Material Co., South Milwaukee, Wis. (Oil Switches.)
Maple Co., R. H., Indianapolis, Ind.
Martindale Elec. Co., 1262 W. Fourth, Cleveland, O.
Minibraker. See Burke Controller Co.
Roller-Smith Co., 239 Broadway, New York, N. Y.
Sentinel. See Westinghouse Elec. & Mfg. Co.
Takamine Corp., 208 Rawson, Long Island City, N. Y.
Trumbull-Vanderpool Elec. Mfg. Co., Bantam, Conn.
U-Re-Lite. See I. T. E. Circuit Breaker Co.
Ward Leonard Elec. Co., Mount-Vernon, N. Y.
Westinghouse Elec. & Mfg. Co., East Pittsburgh, Pa.

CIRCUIT TESTERS. See Testers, Fuse and Circuit.
CLEANER BAGS, Vacuum. See Bags, Vacuum Cleaner.
CLEANER BRUSHES, Vacuum. See Brushes for Vacuum Cleaners.

CLEANERS, Metal
Oakite Products, Inc., 26 Thames, New York, N. Y.

CLIPS, Fuse. See Fuse Clips.

CLIPS, Heater Plug
Gray Bros. Co., Plano, Ill.

CLOCK SWITCHES. See Switches, Time.
CLOTH GEARS. See Gears and Pinions, Composition.
CLOTH LOUD SPEAKER DIAPHRAGM. See Cloth, Untreated.
CLOTH RADIO GRILL. See Cloth, Untreated.

CLOTH UNTREATED
Canvas, "Aeroplane Cloth," Cotton Duck, Drill, Diaphragm Cloth, Grill Fabrics, etc
Boyle & Co., John, 112 Duane, New York, N. Y.
Tendall Fabrics Corp., Pawtucket, R. I. (Grill Cloth.)

CLOTH AND PAPER, Insulating

Cloth, Insulated ..... See C
Paper, Insulated ..... See P
Fibre Paper (Fish Paper) ..... See F
Press Board (Fuller Board) .... See B
Silk ..... See S

Acme Wire Co., New Haven, Conn..... C S P . . .
Armatite. See Mica Insulator Co.
Brand & Co., Wm., 268 Fourth Ave., New York ..... P . . .
Campbellite. See Campbell Fibre Co.
Campbell Fibre Co., Stanton, Delaware..... B
Carboloid Products Corp., 15 Park Row, New York, N. Y..... C . . P . . .
Case Brothers, Inc., Highland Park, Conn.. . . . . B
Case Mfg. Co., Unionville, Conn..... P . . .
Case & Risley Press Paper Co., Oneco, Conn. . . . . .
C-F. See Campbell Fibre Co.
Celoron Co., Bridgeport, Pa..... P F B
Chicago Mica Co., Valparaiso, Ind..... C . . . . . .
Dexstar. See Dexter & Sons.
Dexter & Sons, C. H., Windsor Locks, Conn. (Condenser Tissue.)
Diamond State Fibre Co., Bridgeport, Pa.. . . . P . . .
Dielectric Mfg. Co., St. Louis, Mo..... C S P . . B
Federal Insulating Corp., Yonkers, N. Y... C . . P F . .
Fyberoid. See Wilmington Fibre Specialty Co.
General Electric Co., Merchandise Dept., Bridgeport, Conn. ..... C . . P . . .
Hartford City Paper Co., Hartford City, Ind. (Glassine Condenser Tissue).
Hewitt & Bros., C. B., 16 Ferry, New York C . . P . . .
Hi-Tex. See Stevens Paper Mills.
Incella. See Tarentum Paper Mills Co.
Irvington Varnish & Insulator Co., Irvington, N. J. ..... C S P . . .
Manning Paper Co., J. A., Troy, N. Y..... B
Mica Insulating Co., 200 Varick, New York C S P . . B
Mitchell-Rand Mfg. Co., 19 Vesey, New York, N. Y. ..... P . . .
National Vulcanized Fibre Co., Wilmington, Del. ..... F . .
New Jersey Wood Finishing Co., Woodbridge, N. J. ..... C . . . . . .
Ohmoid. See Wilmington Fibre Specialty Co.
Old Hick. See Hewitt & Bros., C. B.
Peerless. See National Vulcanized Fibre Co.
Rogers Fibre Co., 210 Lincoln, Boston, Mass. . . . . F . .
Rogers Paper Mfg. Co., South Manchester, Conn. ..... B
Schweitzer, Peter, 200 Fifth Ave., New York, N. Y. (Condenser Tissue.)
Scutan Co., 342 Madison Ave., New York . . . . P . . . .
Sico. See Standard Insulation Co.
Spaulding Fibre Co., Tonawanda, N. Y.. . . . . F . . .
Standard Insulation Co., Rutherford, N. J. C S P . . . .
Sterling Fireboard Co., 501 Fifth Ave., New York. (Varised Hard Fibreboard)..... B
Sterlite. See Sterling Firebrand Co.
Stevens Paper Mills, Windsor, Conn..... B
Tarentum Paper Mills Co., Tarentum, Pa.. . . . P . . .
Turbonite. See Brand & Co., Wm.
Union Mills Paper Mfg. Co., New Hope, Pa. . . . P . . .
Warren Mfg. Co., 342 Madison Ave., New York, N. Y. ..... P . . .
West Virginia Pulp & Paper Co., 200 5th Ave., New York..... B

Wilmington Fibre Specialty Co., Wilmington, Del. ..... P . . .

CLUTCHES, Magnetic
Cutler-Hammer Mfg. Co., Milwaukee, Wis.

COIL (Coils).
Armature and Field. See Coils, Finished.
Choke (Power). See Fittings, High Tension.
Choke (Radio). See Radio Circuit Components.
Driers & Impregnators. See Ovens.
Electromagnet. See Coils, Finished.
Flatteners. See Rolls, Coil Flattening.
High Frequency. See Electro-Therapeutic; also Radio Circuit Components; also Ignition Outfits.
Impregnators, Vacuum. See Ovens, Industrial.
Induction. See Coils, Finished; also Electro-Therapeutic.
Loop Benders. See Benders, Coil Loop.
Medical. See Electro-Therapeutic.
Presses. See Presses, Armature Coil.
Radio. See Radio Circuit Components.
Removers. See Removers, Coil.
Resistance. See Units, Rods & Grids; also Radio Circuit Components.
Shaping Machines. See Shaping Machines, Coil.
Spark. See Ignition Outfits.
Spreaders. See Winding Machines, Armature & Field Coil.
Taping Machines. See Taping Machines, Coil.
Tesla. See Ignition Outfits.
Testers. See Testers, Coil; also Test Benches, Armature.
Winders, Armature & Field Coil. See Winding Machines, Armature & Field Coil.
Winders, Induction Coil. See Winding Machines, Industrial Coil.
Winding Forms. See Forms, Coil Winding.
Winding (Magneto). See Coils, Finished.
Wire Tension Devices. See Tension Devices, Coil Wire.

COILS, Finished
Armature, Field, Electromagnet and Induction Coils.
Acme Products Co., 22 Elkins (South Boston), Boston, Mass.
Acme Wire Co., New Haven, Conn.
Aero Products, Inc., 1772 Wilson Ave., Chicago, Ill.
Auth Electrical Specialty Co., 422 E. 53rd St., New York, A. & A. See Electrical Coil Winding Co.
Belden Mfg. Co., 2310B S. Western Ave., Chicago, Ill.
Bunnell & Co., J. H., 32 Park Place, New York, N. Y.
Burke Controller Co., 369 Lexington Ave., New York, N. Y.
Cameron Elec. Mfg. Co., Ansonia, Conn.
Coilton Elec. Mfg. Co., Easton, Pa.
Dudlo Mfg. Co., Div. of General Cable Corp., Fort Wayne, Easton Coil Co., Easton, Pa.
Electric Heat Control Co., 5902 Carnegie Ave., Cleveland, O.
Electrical Coil Winding Co., 27th & Sanderson Sts., Camden,
Electrical Products Mfg. Co., Providence, R. I.
Irvington Varnish & Insulator Co., Irvington, N. J.
Marion Elec. Mfg. Co., 24 Cliff, Jersey City, N. J.
Modern Elec Mfg. Co., 312 Mulberry, Toledo, Ohio.
National Elec. Corp., 226 High, Newark, N. J.
Pifer Elec. Repair & Mfg. Co., 3610 Superior Ave., Cleveland, O.
Robertson-Davis Co., 412 Orleans, Chicago, Ill.
Robertson, Leo F., 536 West 22nd St., New York, N. Y.
Sevison Magneto Engrg. Co., 397 Phillips, Toledo, O.
Stunz & Barron, 210 E. Pratt, Baltimore, Md.
Toledo Standard Commutator Co., 2342 Smead Ave., Toledo, O.
Universal Winding Co., Boston, Mass.
U. S. Armature Service Co., 1617 S. Michigan Ave., Chicago, Ill.
Varley Duplex Magnet Co., 15 Exchange Place, Jersey City, N. J. (Electromagnetic only).
Whittier & Ditmar, Inc., 1611 Beacon, Brookline, Mass.

COMMUTATOR
Bars. See Bars, Commutator.
Cement. See Cement, Commutator.
Dressers. See Stones, Commutator.
Lubricants. See Compounds, Commutator.
New. See Commutators.
Refilled. See Repairing and Second Hand.
Slotters. See Slotting Machines & Tools, Commutator.
Slotting Files. See Files, Commutator Slotting.
Soldering Machines. See Soldering Machines, Commutator.
Stones. See Stones, Commutator.
Tighteners. See Tighteners, Commutator.
Truing Devices. See Tools, Commutator Truing.

COMMUTATORS
Derby Commutator Co., Derby, Conn.
Eureka Copper Products Corp., North East, Pa.
Homer Commutator Co., Cleveland, Ohio.

COMMUTATOR BRUSHES. See Brushes, Commutator.
COMPOSITION PULLEYS. See Pulleys, Composition.
COMPOUNDS, Sealing. See Wax and Compounds.

CONDENSER UNITS, Refrigerator
Bush Mfg. Co., Hartford, Conn.
McCord Radiator & Mfg. Co., Riopelle & E. Grand Ave., Detroit, Mich.
Rome-Turney Radiator Co., Rome, N. Y.

CONDENSERS, Radio. See Radio Circuit Components.
CONDENSER TUBING. See Tubing, Brass and Copper.
CONTACT POINTS. See Points, Contact.
CONTAINERS, Shipping. See Fibre Board Products.

CONTROLLERS, Motor
Allen-Bradley Co., 493 Clinton, Milwaukee, Wis.
Anderson & Co., C. J., 212 W. Austin, Chicago, Ill.
Automatic Switch Co., 154 Grand, New York, N. Y.
Betts, Inc., James H., 1393 Sedgwick Ave., New York, N. Y. (Traffic.)
Burke Controller Co., 369 Lexington Ave., New York, N. Y.
B-Q Oil Burner Co., Stockton, Cal.
Clark Controller Co., 1146 E. 152nd, Cleveland, O.
Condit Elec'l Mfg. Corp., 838 Summer St. (South Boston), Boston, Mass.
Cutler-Hammer Mfg. Co., 1288 St. Paul Ave., Milwaukee.
Dinkey. See Elec. Controller & Mfg. Co.
E C & M Youngstown. See Electric Controller & Mfg. Co.
Electric Controller & Mfg. Co., 2700 E. 79th, Cleveland, O.
Electrite. See Sundh Elec. Co.
Diamond Elec. Mfg. Co., 1330 N. 16th, Los Angeles, Cal.
General Electric Co., Schenectady, N. Y.
Horni Signal Mfg. Corp., 292 Hudson, New York, N. Y.
Industrial Controller Co., S. Pierce & Hanover, Milwaukee, Wis.
Malmin Co., H., 251 W. 19th, New York. (Sewing Machines.)
Monitor Controller Co., 51 Gay, Baltimore, Md.
National Electric Controller Co., 5315 Ravenswood Ave., Chicago, Ill.
Refrigerating Specialties Co., 728 S. Sacramento Blvd., Chicago, Ill.
Rowan Controller Co., 306 N. Holliday, Baltimore, Md.
Square D Co., 6060 Rivard, Detroit, Mich.

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Thermaload. See Monitor Controller Co.
Trumbull Electric Mfg. Co., Plainville, Conn.
Uemco. See Union Elec. Mfg. Co.
Union Elec. Mfg. Co., Milwaukee, Wis.
U. S. Elec'l Mfg. Co., 200 E. Slauson Ave., Los Angeles.
Westinghouse Elec. & Mfg. Co., East Pittsburgh, Pa.
W. K. See Westinghouse Elec. & Mfg. Co.

COPPER. See Brass, Bronze and Copper; also Castings.
COPPER TUBING. See Tubing, Brass and Copper.
CORD TIPS. See Tips, Cord.

CORES, RESISTANCE COIL (Lava)
American Lava Corp., 1425 William, Chattanooga, Tenn.
Crescent. See M. Kirchberger & Co.
Ea-El-Co. See Southern Lava Co.
Kirchberger & Co., M., 1425 37th, Brooklyn, N. Y.
Lavite. See Steward Mfg. Co.
Lavarock. See M. Kirchberger & Co.
Southern Lava Co., Rossville, Ga.
Steward Mfg. Co., D. M., Chattanooga, Tenn.
Tennessee Burner Mfg. Co., Chattanooga, Tenn.
XL. See Tennessee Burner Mfg. Co.

CORES, RESISTANCE COIL (Refractory Porcelain)
American Lava Corp., 1425 William, Chattanooga, Tenn.
Colonial Insulator Co., Akron, O.
Crowley & Co., Henry L., 545 N. Arlington Ave., East Orange, N. J.
Electrical Refractories Co., East Palestine, O.
Elemite. See Louthan Mfg. Co.
Fireite. See Hartford Faience Co.
Hartford Faience Co., Hartford, Conn.
Louthan Mfg. Co., E. Liverpool, O.
Thermal Syndicate, 58 Schenectady Ave., Brooklyn, N. Y.
Vitreosil. See Thermal Syndicate.

COTTON DUCK. See Cloth, Untreated.
COTTON SLEEVING. See Tape, Cotton.
COUNTERS, Revolution. See Tachometers.

COUPLINGS, Shaft (Flexible-Insulated)
Bartlett Hayward Co., Baltimore, Md.
Delbee Rubber Co., Syracuse, N. Y.
Falk Corp., Milwaukee, Wis.
Franke. See Smith & Serrell.
General Electric Co., Schenectady, N. Y.
Lipe, W. C., Syracuse, N. Y.
Lovejoy Tool Wks., 319 W. Ohio, Chicago, Ill.
Oneida. See Delbee Rubber Co.
Smith & Serrell, 24 Washington Pl., Newark, N. J.
Wood's Sons Co., T. B., Chambersburg, Pa.

COVERING MACHINES, WIRE. See Wire Manufacturing Machines.

CUPS, Grease
Bowen Products Corp., Auburn, New York.
Lunkenheimer Co., Cincinnati, Ohio.

CUT OUTS, Battery. See Switches, Battery.
CUTTING OUTFITS, Metal. See Welding and Cutting Outfits.

CRANES, Floor. See Lifts, Armature.

CRYSTALS, Chandelier
Crystals, Prisms, Beads, Chains, Fringes.
Crystal Venezia. See Harrison & Co., Arthur.
Friedlaender Co., 49 W. 23rd, New York, N. Y.
Harrison & Co., Arthur, 561 W. Washington Blvd., Chicago.
Hirschberg, Shutz & Co., 268 4th Ave., New York, N. Y. (Fringes.)
Nelson Bead Co., 15 W. 37th, New York, N. Y. (Importer.)
Rialto Import Co., 112 W. 4th, New York, N. Y.
Schwartz Lighting Fixture Wks., 1341 Noble, Philadelphia.
Wyle & Bros., J. J., 20 E. 27th, New York, N. Y.

CURRENT INDICATORS. See Instruments, Pocket.
DASHBOARD METERS. See Instruments, Portable and Switchboard.

DECALCOMANIA
Meyercord Co., 133 W. Washington, Chicago, Ill.
Novar. See Palm Fechteler & Co.
Palm Fechteler & Co., 67 5th Ave., New York, N. Y.

DIALS
Radio (Metal). See Radio Mountings.
Radio (Molded). See Radio Molded Parts.
Enameled. See Dials, Enameled.

DIALS, Enameled
Whittier Co., Horace R., Pequabuck, Conn.

DIAPHRAGM, Cloth. See Cloth, Untreated.
DIE CASTINGS. See Castings, Die.
DIE MAKERS. See Dies, Die Makers.
DIES, Pipe. See Stocks, Dies and Reamers.

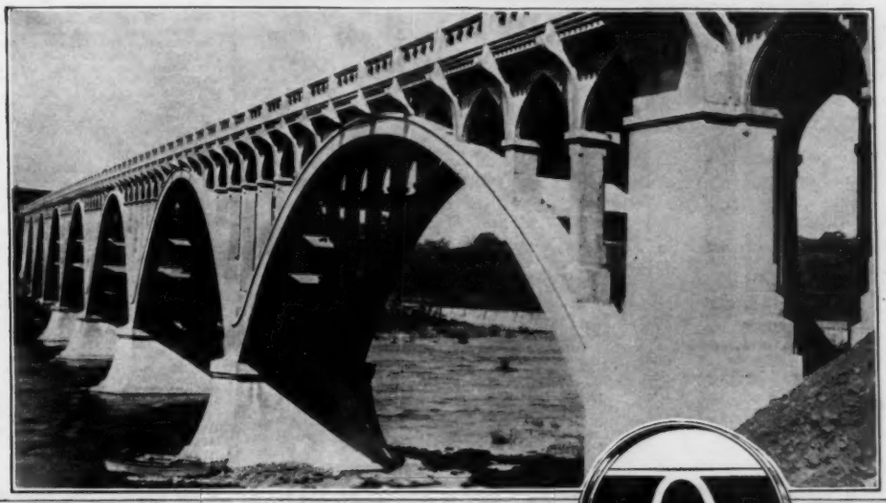
DIES, DIE MAKERS
Baumbach Mfg. Co., 1810 S. Kilbourn Ave., Chicago, Ill.
Beaver Mfg. Co., 625 N. Third, Newark, N. J.
Eureka Tool & Machine Co., 42 Walnut, Newark, N. J.
Mareck & Nebel, 255 Greenwich, New York, N. Y.

DISCS, Armature
Steel Discs, Laminations, and Segments for Motors and Transformers.
American Stamping Co., 978 E. 64th, Cleveland, O.
Cleveland Armature Works, 4732 St. Clair Ave., Cleveland.
Hercules Elec. Steel Corp., 145 Lafayette, New York, N. Y.
Lamination Stamping Co., 764 Windsor, Hartford, Conn.

DRAWING MACHINES, WIRE. See Wire Drawing Machines.
DRIVE SCREWS. See Screws, Drive.
DRIVES, CHAIN. See Chain, Power Transmission.

DYNAMOMETERS
Westinghouse Elec. & Mfg. Co., East Pittsburgh, Pa.
Clark Controller Co., 1146 E. 152nd, Cleveland, O.
Diehl Mfg. Co., Elizabeth, N. J.
General Electric Co. Schenectady.

EBONITE. See Rubber, Hard.
ELECTROLYTE. See Chemicals, Battery.
ELECTROMAGNETS. See Coils, Finished.



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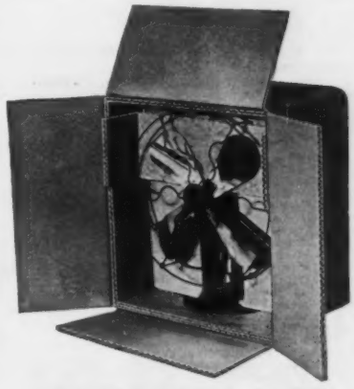

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Deckel. See Preis & Co., Inc., H. P.
Engravograph Corp., 12 Vestry, New York, N. Y.
Etchograph. See Brewster Co., Wm.
Gilbert Supply Co., Independence, Iowa.
Gorton Machine Co., Geo., Racine, Wis.
Preis & Co., Inc., H. P. Newark, N. J.

ENGRAVING, Radio Panel
Engraving to Order.
Eastern Specialty Co., 3551 N. Fifth, Philadelphia, Pa.
Etch-O-Gravure. See Insuline Corp. of America.
Globe Mfg. Co., 101 Spokane St., Seattle, Wash.
Insuline Corp. of America, 78 Cortlandt, New York, N. Y.
New England Products Co., 232 Greenwich, New York.
Preis & Co., Inc., H. P., Newark, N. J.
Schwenke Machine Engraving Co., 2036 Woodward Ave., Detroit, Mich.
Verichrome Laboratories, 4614 Spring Grove Ave., Cincinnati, Ohio.
Wright Radio Co., 114 Exchange, Rockland, Mass.
ENGRAVING TO ORDER. See Engraving, Radio Panel.

EYELETS
Platt Bros. & Co., Waterbury, Conn.
FABRIC, Radio Grill. See Cloth, Untreated.
FABRIC SHADES. See Shades, Fabric.
FAN BLADES. See Blades, Fan.
FEET, FELT. See Felt.

FELT
Advance Felt & Cutting Co., 317½ S. Jefferson, Chicago.
American Felt Co., 211 Congress, Boston, Mass.
Booth Felt Co., 460 18th, Brooklyn, N. Y.
Brawley, T. E., 279 20th, Brooklyn, N. Y.
Western Felt Wks., 4031 Ogden Ave., Chicago, Ill.

FERRULES
Chase Brass & Copper Co., Waterbury, Conn.
Clark Metal Products, 490 Hancock Ave., Bridgeport, Conn.
Grammes & Sons, Inc., L. F., Allentown, Pa.
Massachusetts Machine Shop, Inc., Boston, Mass.
Patton-MacGuyer Co., Providence, R. I.
Platt Bros. & Co., Waterbury, Conn.
Risdon Mfg. Co., Naugatuck, Conn.
Scovill Mfg. Co., 99 Mill, Waterbury, Conn.
Waterbury Brass Goods Corp., Waterbury, Conn.
Waterbury Button Co., Waterbury, Conn.

FIBRE BOARD PRODUCTS (Solid and Corrugated)
Container Corp. of America, 111 W. Washington, Dept. 36, Chicago, Ill.
Mid-West Box Co., Dept. 6, 111 W. Washington, Chicago.
Sefton Mfg. Corp., 59 E. Madison, Chicago, Ill.
FIBER CANDLES. See Candles, Fixture.
FIBRE GEARS. See Gears and Pinions, Composition.
Paper. See Cloth and Paper.
Radio Panels. See Radio Molded Parts.
Shipping Containers. See Fibre Board Products.
Vulcanized. See Fibre, Vulcanized.

FIBRE, Phenol
Moisture Proof; Sheet, Rod, Tubes.
Bakelite-Dilecto. See Continental Fibre Co.
Bakelite-Duresto. See Spaulding Fibre Co.
Campbell Fibre Co., Heather Ave., Stanton, Del.
Campbellite. See Campbell Fibre Co.
Celoron Co., Bridgeport, Pa.
Continental Fibre Co., Newark, Del.
Fibroc Insulation Co., 245 Lincoln Ave., Valparaiso, Ind.
Formica Insulation Co., 4638 Spring Grove Ave., Cincinnati, O.
Micarta. See Westinghouse Elec. & Mfg. Co.
National Vulcanized Fibre Co., Wilmington, Del.
Phenolite. See National Vulcanized Fibre Co.
Spaulding Fibre Co., Inc., Tonawanda, N. Y.
Westinghouse Elec. & Mfg. Co., East Pittsburgh, Pa.

FIBRE, Vulcanized
Sheet, Rod, Tube, Horn, Fibre, Bushings, Washers, Cleats, Screw Machine Products.
Agasote Millboard Co. (Fernwood), Trenton, N. J.
Brandywine Fibre Products Co., 1402 Walnut St., Wilmington, Del.
Campbell Fibre Co., Heather Ave., Stanton, Del.
Canite. See Continental Fibre Co.
Cocheco. See Spaulding Fibre Co.
Continental Fibre Co., Newark, Del.
Delaware Hard Fibre Co., Wilmington, Del.
Diamond F. See Diamond State Fibre Co.
Diamond State Fibre Co., Bridgeport, Pa.
Egyptian. See Delaware Hard Fibre Co.
Electrosote. See Agasote Millboard Co.
Fibre Products Co., New Bedford, Mass.
Fiberoid. See Wilmington Fibre Specialty Co.
Independent Laboratories, 50 E. 42nd, New York, N. Y.
Iten Fibre Co., 5403 Bower Ave., Cleveland, O.
Leatheroid. See Rogers Fibre Co.
Lincoln Fibre & Specialty Co., Newport, Del.
National Vulcanized Fibre Co., Wilmington, Del.
Ohmoid. See Wilmington Fibre Specialty Co.
Peerless. See National Vulcanized Fibre Co.
Rogers Fibre Co., 210 Lincoln, Boston, Mass.
Spaulding Fibre Co., Tonawanda, N. Y.
Standard Fibre Products Co., 36 Pleasant, Watertown, Mass.
Vul-Cot. See National Vulcanized Fibre Co.
Vulcawood. See Diamond State Fibre Co.
Wilmington Fibre Specialty Co., Wilmington, Del.
FIBRE WASHERS. See Fibre.
FIELD COILS. See Coils, Finished.

FILAMENTS, Incandescent Lamp
Conneway Elec. Laboratories, 406 Jefferson St., Hoboken.
Filament Supply Co., 1317 Willow Ave., Hoboken, N. J.
Sirian Wire & Contact Co., 255 Sherman Ave., Newark.
Suter & Nuetzi, 3709½ Lisbon Ave., Milwaukee, Wis.
Volkmar & Sons, 187 Sylvan Ave., Newark, N. J. (Lead-in-Welds.)

FILES, Commutator Slotting
Ideal Commutator Dresser Co., 1039 Park, Sycamore, Ill.
Martindale Electric Co., 1264 W. Fourth, Cleveland, O.
FISH PAPER. See Cloth and Paper.
FITTINGS, Fixture. See Fixture Fittings.
FIXTURE CANDLES. See Candles, Fixture.
FIXTURE CHAIN. See Chain, Fixture.
FIXTURE, Collars. See Fixture Fittings.

FIXTURE FITTINGS

	KEY
Bowl Holders	See B
Brass Fittings	See B
Canopies	See B
Collars	See B
Crow Feet	See I
Finials (Brass, Glass and Porcelain)	See B

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	KEY
Hangers	See H
Hickies, Brass	See B
Hickies, Iron	See I
Hooks, Brass	See B
Hooks, Iron	See I
Iron Fittings	See I
Loops, Brass	See B
Loops, Iron	See I
Rings	See B
Shade Holders	See S
Shells	See B
Spinnings	See B
Stampings	See B
Stems	See B
Straps	See H
Studs	See I

Acme Lighting Products, Inc., 2114 Woodland Ave., Cleveland, O. Straps ..... H
American Chain Co., Bridgeport, Conn. (Loops and Rings.) ..... B
American Pin Co., Waterbury, Conn. I
American Ring Co., Waterbury, Conn. (Candle.) ..... S
Ampinco. See American Pin Co.
Appleton Electric Co., 1703 Wellington Ave., Chicago, Ill. ..... B I
Arco. See American Ring Co.
Arrow Electric Co., Hartford, Conn. ..... S
Banlite. See East Side Metal Spinning Co.
Banner. See Plume & Atwood Mfg. Co.
Barton Brass Wks., 3627 Superior, Detroit .. B
Belmet. See B. & L. Metal Stamping Co.
Bloch Bros., 88 Walker, New York ..... B
Brandt Mfg. Co., 3727 Gratiot Ave., Detroit. B
Braun, J. G., 609 S. Paulina, Chicago, Ill. (Pressed Ornaments.) ..... B I
B. & L. Metal Stamping Co., 250 Moore, Brooklyn, N. Y. (Also Combination Wall Bracket Hanger.) ..... B I .. H
Cambridge Brass Co., Cambridge, Mass. ..... B
Chase Brass & Copper Co., Waterbury, Conn. B .. S
Cleanexy. See Dunlap Co.
Colonial Stamping Co., Brill St. & Passaic Ave., Newark, N. J. ..... B .. S
Crescent Brass Mfg. Co., Reading, Pa. ..... B
Crouse-Hinds, Solvay Sts., Syracuse, N. Y. ..... S H
Diamond Needle & Mfg. Co., Torrington, Conn. (Hickies.) ..... B I
Dunlap Co., John, Carnegie, Pa. ..... S
East Side Metal Spinning Co., 451 Greenwich, New York, N. Y. ..... B
Eureka Tin Ware Mfg. Co., 135 W. 20th, New York, N. Y. ..... S
E-Z Up. See Plume & Atwood Mfg. Co.
Faries Mfg. Co., Decatur, Ill. ..... B I S H
Flaherty Co., M. E., 28 S. Clinton, Chicago .. I
Fralick Co., S. R., 15 S. Clinton, Chicago .. I
Franklin Brass Foundry Co., Reading, Pa. ... B
Friedley-Voshardt Co., Chicago ..... B
Full-O-Lite Co., 50 Dey, New York, N. Y. ... B
Grabler Mfg. Co., 6565 Broadway, S. E., Cleveland, O. I
Hart & Hegeman Mfg. Co., Hartford, Conn. ... S
Incandescent Supply Co., 468 West Broadway, New York, N. Y. ..... B H
Isco. See Incandescent Supply Co.
Jiffy. See White Mfg. Co., J. H.
Kwikon. See Fralick Co., S. R.
Lakin. See Thomas & Betts Co.
Lanco Mfg. Co., 228 Jelliff Ave., Newark, N. J. (Cross Bar.) I
Liberty Brass Turning Co., 203 Lafayette, New York, N. Y. I
Liberty Iron Pipe & Nipple Works, 62 Greene, New York, N. Y. ..... B I
Liberty Machine Co., Wauwatosa, Wis. ..... B I
L & K Mfg. Co., 440 Adelphi, Brooklyn, N. Y. ... H
L. & W. Brass Wks., 820 Orleans, Chicago, Ill. B
Madelite. See Belson Mfg. Co.
M. & W. Mfg. Co., 1527 Niagara Ave., Buffalo, N. Y. I
Macallen Co., Foundry St., Boston, Mass. I
Metal Products Co., 210 Canal, New York ... B
Metro Iron Ornament Co., 191 Christie, New York, N. Y. I
Metropolitan-Columbia Mfg. Co., 714 Metropolitan Ave., Brooklyn, N. Y. ..... B
Midwest Elec. Co., 1639 Walnut, Chicago, Ill. .. I
Mid-West Chandelier Co., 14th & Chestnut Sts., Kansas City, Mo. ..... B
Michell-Vance Co., 70 Washington, Brooklyn, N. Y. ..... S
Monarch. See Perfeclite Co.
Murlin Mfg. Co., Philadelphia, Pa. ..... B I
National Electric Products Corp., 1110 Fulton Bldg., Pittsburgh, Pa. (Studs.) I
New Era Elec. Mfg. Co., 6725 Machinery Ave., N. E., Cleveland, O. ..... H
New Wrinkle. See Bryant Elec. Co.
New York Brass Turning Co., 568 Broadway, New York, N. Y. ..... B
Nobolt. See Fralick & Co., S. R.
N. W. Cleat Receptacle Bracket, 2437 N. 29th, Philadelphia, Pa. I
Onil. See Perfeclite Co.
Pass & Seymour, Solvay Sta., Syracuse, N. Y. B .. S
Perfeclite Co., 1457 E. 40th, Cleveland ..... S
Pittsburgh Valve & Fittings Co., Barberton, O. .. I
Plume & Atwood Mfg. Co., Waterbury, Conn. B .. S H
Plumwood. See Plume & Atwood Mfg. Co.
Plymouth. See Vester Sons, Alfred.
Reading Brass Co., 141 Schiller, Reading, Pa. B I
Ribaysen Mfg. Co., J., 952 W. Lake, Chicago, Ill. B
Rosale Mfg. Co., 200 Hudson, New York .... B
Sandow Tool Co., 1440 Bway, New York, N. Y. ... S
Scovill Mfg. Co., Waterbury, Conn. ..... B I
Simpalite. See Sprecher Mfg. Co., P. W.

Simplex. See Plume & Atwood Mfg. Co.
Smoot-Holman Co., Inglewood, Cal. (Ceiling Reflectors) ..... B
Springfast. See Plume & Atwood Mfg. Co.
Square-G. See Grabler Mfg. Co.
Standard Elec. & Mfg. Co., Cedar Rapids, Ia. B
Standard Snap-Lite Corp., 504 Jackson Ave., Long Island City, N. Y. ..... S
Standard Metal Spinning Co., 128 Mott, New York, N. Y. ..... B
Star. See Perfeclite Co.
Star. See Steel City Elec. Co.
Steel City Elec. Co., Pittsburgh, Pa. I
Steele & Johnson Mfg. Co., Waterbury, Conn. B .. S
Stembridge, Tenny & Brandt, 29 S. Clinton, Chicago, Ill. (White Metal.) ..... B
Sterling Spinning & Stamping Wks., 476 Broome, New York, N. Y.
T. & B. See Thomas & Betts Co.
Thomas & Betts Co., 63 Vesey, New York I
Triumph Mfg. Co., 310-13, West New York, N. J. ..... S
Uno. See Bryant Elec. Co., also Crouse-Hinds, also General Elec. Co., also Hart & Hegeman Mfg. Co., also Pass & Seymour.
United. See L. & K. Mfg. Co.
United Metal Spinning Co., 440 Adelphi, Brooklyn, N. Y. ..... B
Vester, Sons, Alfred, 5 Mason, Providence, R. I. B
Victor. See Plume & Atwood Mfg. Co.
Virden, Div. of Gill-Virden Co., 6108 Longfellow Ave., Cleveland, O. ..... B
Walden Tool & Metal Mfg. Co., New Haven Conn. .....
Wa-Me-Co. See Waterbury Metal Wares Co.
Waterbury Co., Waterbury, Conn. ..... B
Waterbury Metal Wares Co., Waterbury, Conn. ... S
Weber Brass Co., Whitney Power Block, Cleveland, O. ..... B
White Diamond. See White Mfg. Co., J. H.
White Mfg. Co., J. H., 111 N. 3rd, Brooklyn, N. Y. ..... B .. S
Wilhite Machine Wks., 1245 S. Hope, Los Angeles, Cal. ..... B
Zamora. See American Pin Co.

FLASHERS, Sign
Motor Flashers, Thermal Flashers, Flashing Sockets and Plugs.
Ajax. See Reynolds Spring Co.
A. & W. See General Outdoor Adv. Co.
Angelus. See Electric Sign Flasher Corp.
Betts, Inc., James H., 1393 Sedgwick Ave., New York. (Motor Flashers, Thermal Flashers, Flashing Sockets and Plugs.)
Betts & Betts Corp., 645 W. 43rd, New York, N. Y. (Motor Flashers.) (Thermal Flashers.) Flashing Plugs.)
California Sign Flasher Co., 280 Guttenberg, San Francisco, Cal.
Cramblet Engineering Corp., 280 Guttenberg, Milwaukee.
Commercial Elec. Co., 1203 E. Grant, Portland, Ore.
Diamond. See General Appliance Corp.
Dominic. See Kala-Flasher Co.
Eagle Elec. Mfg. Co., 59 Hall, Brooklyn, N. Y.
Electric Sign Flasher Corp., 1826 W. 9th, Los Angeles, Cal.
Figuregram. See Reynolds Electric Co.
Flash O-Lite. See Betts, Inc., James H.
Flip-Flop. See Betts, Inc., James H.
Gem Engineering Co., Hempstead, N. Y.
Gacor. See General Appliance Corp.
General Appliance Corp., 120 8th, San Francisco, Cal. (Flasher Button.)
General Controler Co., 200 E. First, Dayton, O.
Grazier Elec'l Products Co., Johnstown, Pa.
Horni Signal Mfg. Co., 292 Hudson, New York, N. Y.
Hotchkiss. See Cramblet Engineering Corp.
Jewel Elec. & Mfg. Co., 4505 Ravenswood Ave., Chicago, Ill.
Jimbetts. See Betts, Inc., James H.
Kala-Flasher Co., 344 N. Church, Kalamazoo, Mich.
Killark. See Betts & Betts Corp.
Kontroler. See General Controler Co.
Magnetic Sign Flasher Co., Seattle, Wash.
Mercury. See Betts, Inc., James H.
Opaiume Sign System, Battle Creek, Mich.
Phelps Elec. Co., 29 S. Clinton, Chicago, Ill. (Motorless)
Phoenix Products Co., Phoenix, N. Y.
Presto Products Co., 64 University Place, New York, N. Y. (Sockets and Plugs.)
Reco. See Reynolds Elec. Co.
Reynolds Elec. Co., 2650 W. Congress, Chicago, Ill.
Reynolds Spring Co., Jackson, Mich.
Rodale Mfg. Co., 200 Hudson, New York, N. Y.
Ryan. See Phoenix Products Co.
Skeloodle. See Phelps Elec. Co.
Sokit. See Betts, Inc., James H.
Thermo-Wynk. See Betts & Betts Corp.
Vacu. See Betts & Betts Corp.
Veebar. See Betts, Inc., James H.
Way, Eugene W., Seattle, Wash.
Wood Electric Co., C. D., 565 Broadway, New York N. Y.
Woodwin. See Wood Elec. Co., C. D.
Wynk-A-Lyte. See Betts & Betts Corp.
FLASHLIGHT LENSES. See Lenses.
FLEXIBLE ARMS. See Tubing, Flexible Metallic.
FLEXIBLE LEADS, Commutator Brush. See Brushes, Commutator.
FLEXIBLE SHAFT. See Tubing, Flexible Metallic.

FORGINGS, Non-Ferrous
Scovill Mfg. Co., Waterbury, Conn.

FORMS, Coil Winding
Armature Coil Equipment Co., 2415 Forestdale Ave., Cleveland, O.
Comstock Mfg. Co., Wilkes-Barre, Pa.
Master. See Armature Coil Equipment Co.

FORMS, Wire
Forms and Frames for Shade Holders and Shades: Bending, Welding, Forming.
American Specialty Mfg. Co., 165 Holland Ave., Bridgeport, Conn.
Arrow Wire Frame Corp., 344 E. 23rd, New York, N. Y.
Blake & Johnson Co., Waterbury, Conn.
Central Wire Frame Co., 154 E. 23rd, New York, N. Y. (Complete with socket, cord and plug.)
Chelsea Wire Wks., 675 Hudson, New York, N. Y.
Clark Metal Products Inc., 490 Hancock Ave., Bridgeport, Conn.
Electro Weld Co., 70 Munroe, Lynn, Mass.
Grammes & Sons, Inc., L. F., Allentown, Pa.
Hubbard Spring Co., M. D., Pontiac, Mich.
Hunter Pressed Steel Co., Lansdale, Pa.
Jeschke Wire Specialty Wks., Crawfordsville, Ind.
Krischer's Mfg. Co., 255 Calyer, Brooklyn, N. Y.
Murray Hill Wire Frame Co., 314 E. 32nd, New York, N. Y.
Roebling's Sons Co., John A., Trenton, N. J.
Steinen & Co., 297 Washington, Newark, N. J.
Timberlake & Sons, J. B., Jackson, Mich.
Watral & Sons, 133 E. 16th, New York, N. Y.
Young Industries, Inc., L. A., Detroit, Mich.
FRAMES, Wire. See Forms, Wire.
FRICTION TAPE. See Tape, Rubber and Friction.
FRINGE, Chandelier. See Crystals, Chandelier.

BETTER PUNCHED PARTS AT LOWER COST

Great savings are being secured by manufacturers that use punched parts of Fibroc Bakelite as produced in finished form at the Fibroc Factory and delivered ready for assembly—all perfect pieces.

One user says:

"Since purchasing our requirements from you in finished form, we have secured better work and lowered our costs because we have eliminated die up-keep as well as inspection costs and released punching equipment for other work. In addition, your hot punching methods have enabled us to use a better grade for electrical insulation that we formerly used."

Whether one hundred or one million pieces are required the Fibroc factory is splendidly equipped to produce finished and inspected parts—ready for assembly—AND ON TIME.

Fibroc combines both great di-electric and mechanical strength and is unaffected by oil, water, steam, dilute acids or changing climatic conditions. It will not swell, shrink, warp or change dimension.

***FIBROC** is manufactured in sheets, strips, rods and tubes in standard sizes and grades as well as special grades for specific uses.*

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245 Lincoln Avenue

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Sales offices in the principal cities

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FUSE CLIPS

Sherman Mfg. Co., H. B., Battle Creek, Mich.

FUSE TESTERS. See Testers, Fuse and Circuit.

FUSES AND FUSE WIRE

KEY

Cartridge ..... See C
Plug ..... See P
Non-Refillable ..... See N
Refillable ..... See R
Open Link ..... See O
Fuse Wire ..... See O

Acme Elec. & Mfg. Co., Canal & Hamilton Ave., Trenton, N. J. .. P
Arkless. See Economy Fuse Mfg. Co.
Arrow Electric Co., Hartford, Conn. .. P N
Automatic Elec. Iron & Fuse Co., 215 S. American, Philadelphia, Pa. .. P
Blue Ribbon. See Royal Elec. Co.
Buss. See Bussman Mfg. Co.
Bussmann Mfg. Co., University & Jefferson Ave., St. Louis ..... C P N R O
C. E. Z. See Automatic Elec. Iron & Fuse
Chase-Shawmut Co., Newburyport, Mass... C P N R O
Chicago Jefferson Fuse & Electric Co., 1505 W. 15th St., Chicago, Ill. ..... C P N R O
Clearsite. See Economy Fuse & Mfg. Co.
Clear-Top. See Trico Fuse Mfg. Co.
Colt's Patent Fire Arms Mfg. Co., Hartford, Conn. (Automobile) ..... C .. N R ..
Cote Bros. Mfg. Co., 182 W. Lake, Chicago C P .. R ..
Crystal. See Royal Elec. Co.
Daum Fuse & Elec. Mfg. Co., 1157 Hodgkiss, Pittsburgh ..... C .... R ..
D. & W. See Graybar Electric Co.
Economy Fuse & Mfg. Co., 2717 Greenview Ave., Chicago, Ill. ..... C P N R ..
Eco. See Economy Fuse & Mfg. Co.
Electric Fuseguard Co., Charlottesville, Va.. C P N R ..
Elliott Electric Co., Shreveport, La. .....
Gem. See Chicago-Jefferson Fuse & Electric
General Electric Co., Merchandise Dept., Bridgeport, Conn. ..... C P N R ..
Graybar Electric Co., Graybar Bldg., Lexington Ave. and 43rd St., New York, N. Y. C .....
Great Western Fuse Co., 413 Lexington Ave., New York, N. Y. ..... C .... R ..
H. & H. See Hart & Hegeman Mfg. Co.
Hart & Hegeman Mfg. Co., Hartford, Conn. .. P .. R ..
Hudson Wire Co., Ossining, N. Y. ..... O
Kantark. See Trico Fuse Mfg. Co.
Kirkman Engrg. Co., 1 Dominick St., New York, N. Y. ..... C P N .. O
Littelfuse Laboratories, 1772 Wilson Ave., Chicago, Ill. (Low Capacity, Glass Enclosed, .025 to 2 Amp.) .....
Monarch Fuse Co., Jamestown, N. Y. ..... C .. N R ..
National. See Economy Fuse & Mfg. Co.
Noark. See Colt's Patent Fire Arms Mfg. Co.
Pierce Renewable Fuses, Inc., 752 Main, Buffalo, N. Y. ..... C P .. R ..
Platt Bros. & Co., Waterbury, Conn. ..... O
Powell, F. W., 119 W. Ohio, Pittsburgh .. P .. R ..
Ree-Nu-It Elec. Co., New Bedford, Mass.. C P .. R ..
Rochester Re-Fill Fuse Co., 402 Cottage, Rochester, N. Y. ..... C .. R ..
Royal Elec. Co., Chelsea Station, Boston.. .. P N ....
Simplicity. See Cote Bros. Mfg. Co.
Six-in-One. See Industrial Engrg. Co.
Star Fuse Co., 235 Canal, New York, N. Y. C P .. R ..
Trico Fuse Mfg. Co., 1001 McKinley Ave., Milwaukee ..... C P N R ..
Union. See Chicago-Jefferson Fuse & Electric

GALVANIZING

Cattie & Bros., Joseph P., Gaul and Letterly Sts., Philadelphia, Pa.

GALVANOMETERS. See Instruments, Laboratory Standard.

GAS INERT

Helium Co., Louisville, Ky.
Palstine Industrial Co., 111 Fifth Ave., New York, N. Y.

GASKETS, Rubber

Gutta Percha & Rubber Mfg. Co., 15 Park Row, New York.
Canfield Rubber Co., Bridgeport, Conn.

GAUZE BRUSHES, Wire. See Brushes, Commutator.

GEARS, Fibre. See Gears and Pinions, Composition.

GEARS (Speed Changing Units)

Cleveland Worm & Gear Co., Cleveland, Ohio.
Cullman Wheel Co., 1346 Altgild, Chicago, Ill.
De Laval Steam Turbine Co., Trenton, N. J.
Falk Corp., Milwaukee, Wis.
Foote Bros. Gear & Machine Co., 215 N. Curtis, Chicago, Ill.
Gears & Forgings, Inc., Cleveland, Ohio.
Grant Gear Works, Boston, Mass.
James Mfg. Co., D. O., Chicago, Ill.
Jones Fdry. & Machine Co., W. A., Chicago, Ill.
Lipe, W. C., Syracuse, N. Y.
Nuttall Co., R. D., Pittsburgh, Pa.
Palmer-Bee Co., Detroit, Mich.
Perkins Machine & Gear Co., 125 Circuit Ave., Springfield, Mass.
Philadelphia Gear Works, Philadelphia, Pa.
Smith, Winfield H., Springville, N. Y.

GEARS, Worm

Albaugh-Dover Mfg. Co., Chicago, Ill.
Cleveland Worm & Gear Co., Cleveland, Ohio.
Colburn Gear & Mfg. Co. (Norfolk Downs), Quincy, Mass.
Philadelphia Gear Wks., Philadelphia, Pa.

GEARS AND PINIONS, Composition

Celoron Co., Bridgeport, Pa.
Delaware Hard Fibre Co., Wilmington, Delaware.
Diamond State Fibre Co., Bridgeport, Pa.
Fabroil. See General Elec. Co.
Foote Bros. Gear & Machine Co., 315 N. Curtis, Chicago.
General Electric Co., Schenectady, N. Y.
Medart Co., St. Louis, Mo.
Micarta. See Westinghouse Elec. & Mfg. Co.
National Vulcanized Fibre Co., Wilmington, Del.
Perkins Machine & Gear Co., 125 Circuit Ave., Springfield, Mass.
Stahl Gear Co., 1390 E. 40th, Cleveland, Ohio.
Stranahan Gear Co., Philadelphia, Pa.
Textoil. See General Electric Co.
Textolite. See General Electric Co.
Westinghouse Electric & Mfg. Co., East Pittsburgh, Pa.

GEARS AND PINIONS, Iron and Steel

Earle Gear & Machine Co., Wayne Junction, Philadelphia.
Falk Corp., Milwaukee, Wis.
Gears & Forgings, Inc., Cleveland, Ohio.
Grant Gear Works, Boston, Mass.
James Mfg. Co., D. O., Chicago, Ill.
Medart Co., St. Louis, Mo.
Meisel Bros. Mfg. Co., 944 Dorchester Ave., Boston, Mass.
Perkins Machine & Gear Co., 120 Circuit Ave., Springfield, Mass.
Permag. See Perkins Machine.
Tool Steel Gear & Pinion Co., Cincinnati, Ohio.

GEARS AND PINIONS, Rawhide

Chicago Rawhide Mfg. Co., 1313 Elston Ave., Chicago, Ill.
Gerdes & Co., 50 Church, New York, N. Y.
Syracuse Rawhide Mfg. Co., Syracuse, N. Y.
Western Rawhide & Belting Co., Milwaukee, Wis.

GENERATORS, Electroplating. See Plating Generators.

GLASS BULBS. See Bulbs, Glass.

GLASS CANDLES. See Candles, Fixture.

GLASS LETTERS. See Letters, Sign.

GLASS for Electrical Purposes

Corning Glass Wks., Corning, N. Y.
Pyrex. See Corning Glass Wks.

GLASSWARE

Alba. See Macbeth-Evans Glass Co.
Amazon. See Gleason-Tiebout Glass Co.
Amelites. See Consolidated Lamp & Glass Co.
Apollo. See Gillinder Bros., Inc.
Ardmore. See Jeannette Shade & Novelty Co.
Aurene. See Corning Glass Co.
Aurora. See Consolidated Lamp & Glass Co.
Bayley Sons, 105 Vanderveer, Brooklyn, N. Y.
Beaumont Co., Morgantown, W. Va.
Bellova. See McFaddin & Co., H. G.
Blanco. See Gleason-Tiebout Glass Co.
Beryllite. See Plaut & Co., L.
Camia. See Gleason-Tiebout Glass Co.
Carara. See Gleason-Tiebout Glass Co.
Celestialite. See Gleason-Tiebout Glass Co.
Clearcut. See Ivanhoe Division of Miller Co.
Colcite. See Corning Glass Co.
Consolidated Lamp & Glass Co., Coraopolis, Pa.
Cora. See Consolidated Lamp & Glass Co.
Cora-Lites. See Consolidated Lamp & Glass Co.
Corning Glass Co., Corning, N. Y.
Cremax. See Macbeth-Evans Glass Co.
Crystal. See Phoenix Glass Co.
Daylite. See Wells Glass Co.
Decora. See Macbeth-Evans Glass Co.
Delica-White. See Kopp Glass, Inc.
Druid. See Ivanhoe Division of Miller Co.
Eagle Mfg. Co., Wellsburg, W. Va.
Emeralite. See McFaddin, H. G.
Equalite. See Bayley & Sons.
Erskine Glass & Mfg. Co., Wellsburg, W. Va.
Federal Light & Lens Corp., Star City, W. Va.
Florentine. See Gleason-Tiebout Glass Co.
Geneo. See Ivanhoe Division of Miller Co.
Gillinder Bros., Inc., Port Jervis, N. Y.
Gillinder & Sons, Inc., Philadelphia, Pa.
Gleason-Tiebout Glass Co., 99 Commercial, Brooklyn, N. Y.
Gletleco. See Gleason-Tiebout Glass Co.
Havana. See Kopp Glass, Inc.
Hocking Glass Co., Lancaster, O.
Holophane Glass Co., 342 Madison Ave., New York, N. Y.
Imperial Glass Co., Bellaire, O.
Inland Glass Works, Chicago, Ill.
Ivanhoe Division of Miller Co., Cleveland, Ohio.
Ivory. See Phoenix Glass Co.
Ivre. See Ivanhoe Division of Miller Co.
Jeannette Shade & Novelty Co., Jeannette, Pa.
Jefferson Glass Co., Follansbee, W. Va.
Kauffold Glass & Ceramic Co., Star City, W. Va.
King-Tutankhamen. See Macbeth-Evans Glass Co.
Kopp Glass, Inc., Swissvale, Pa.
Lumina. See Hocking Glass Co.
MacBeth-Evans Glass Co., Dept. G, Eastern Division, Charleroi, Pa.
Magnolia. See Phoenix Glass Co.
Marbo. See Phoenix Glass Co.
McFaddin & Co., H. G., 38 Warren, New York, N. Y.
Melilite. See Gillinder & Sons, Inc.
Micro. See Gillinder & Sons, Inc.
Miller Co., Meriden, Conn.
Monax. See Macbeth-Evans Glass Co.
Moonstone. See Jefferson Glass Co.
N. B. G. See Gillinder & Sons, Inc.
N. U. Glass. See Gillinder & Sons, Inc.
Nebulite. See Gillinder & Sons, Inc.
Nenalite. See Gillinder & Sons, Inc.
Nitro-Glas. See Jefferson Glass Co.
Nuart. See Imperial Glass Co.
Nulite. See Consolidated Lamp & Glass Co.
Nutralux. See Kopp Glass, Inc.
Opalux. See Gleason-Tiebout Glass Co.
Opola. See Inland Glass Co.
Pastelle. See Consolidated Lamp & Glass Co.
Pearlitone. See Inland Glass Co.
Persian. See Gillinder & Sons, Inc.
Phene. See Phoenix Glass Co.
Phoenix Glass Co., 230 Fifth Ave., New York, N. Y.
Pilabrasco. See Kopp Glass, Inc.
Pittsburgh Cut Glass Co., Monaca, Pa.
Plaut & Co., L., 432 E. 23rd, New York, N. Y.
Poly-Case. See Gleason-Tiebout Glass Co.
Prestepal. See Gleason-Tiebout Glass Co.
Quezal Glass Mfg. Co., Fresh Pond Rd. and Metropolitan Ave., Brooklyn, N. Y.
Radiant. See Phoenix Glass Co.
Regent. See Ivanhoe Division of Miller Co.
Rezelle. See Ivanhoe Division of Miller Co.
Rosedora. See Consolidated Lamp & Glass Co.
Shade-O-Tone. See Consolidated Lamp & Glass Co.
Snow-White. See Inland Glass Works.
Star Glass Co., Star City, W. Va.
Sudan. See Ivanhoe Division of Miller Co.
Thebian. See Macbeth-Evans Glass Co.
Translux. See Kopp Glass, Inc.
Trojan. See Ivanhoe Div. of Miller Co.
United Novelty Glass Mfg. Co., 121 Prince, New York, N. Y.
Utopia. See Kopp Glass, Inc.
Velaria. See Ivanhoe Division of Miller Co.
Vineland Flint Glass Wks., Vineland, N. J.
Wells Glass Co., Kokomo, Ind.
Williamsburg Flint Glass Co., 290 Broadway, New York.
Yural. See Ivanhoe Division of Miller Co.
Zanesville Mould Co., Zanesville, O.

GONGS, Unmounted Shells

Bevin Bros. Mfg. Co., East Hampton, Conn.
Bridgeport Brass Co., 774 E. Main, Bridgeport, Conn.
Chase Brass & Copper Co., Waterbury, Conn.
East Hampton Bell Co., East Hampton, Conn.
Gong Bell Mfg. Co., East Hampton, Conn.
Hill Brass Co., M. N., East Hampton, Conn.
Reiter, G. C., Canton, O.

GRAPHITE BEARINGS. See Bearings, Oil-less.

GRID LEAKS. See Radio Circuit Components.

GRIDS, Resistance. See Units, Rods and Grids.

GRILL CLOTH. See Cloth, Untreated.

GROMMETS. See Eyelets.

GROUND LOCATORS. See Instruments, Portable and Switchboard; also Testers, Coil.

GROWLERS, Armature. See Testers, Coil.

HANDLES, Wood; For Switches or Sad Irons

Allen, Chas. E., Pequabuck, Conn.
American Enamel Co., 20 Neville, Providence, R. I.
Bogert & Hopper, 225 Varick, New York, N. Y.
Estes & Son, E. B., 5844 Grand Central Terminal Bldg., New York, N. Y.

Fitchburg Enamel Co., Fitchburg, Mass.
Flanders Hardware Co., North Weare, N. H.
Fuller, J. J. Westfield, Mass.
Narragansett Mach. Co., Pawtucket, R. I.
National Wood Process, New Bedford, Mass.
Novelty Turning Co., Norway, Me.
Ober Mfg. Co., Chagrin Falls, O.
Osborn Mfg. Co., 5401 Hamilton Ave., Cleveland, O.
Piqua Handle & Mfg. Co., Piqua, Ohio.
Royal Enamel Co., Fitchburg, Mass.
Schutz Bros., 152 Chambers, New York, N. Y.
Stiles & Co., H. A., 174 Portland, Boston, Mass.
Stratton Mfg. Co., Stratton, Maine.
Sun Enamel Wks., Leominster, Mass.

HOLDERS, Brush. See Brushes, Commutator.

HOT WIRE METERS. See Instruments, Portable and Switchboard.

ICE CREAM CABINETS. See Refrigerator Cabinets.

IMPREGNATING COMPOUNDS. See Wax and Compounds.

IMPREGNATING, VACUUM. See Ovens, Industrial.

INCANDESCENT LAMP BULBS (Unfinished). See Bulbs, Glass.

INCANDESCENT LAMP FILAMENTS. See Filaments, Incandescent Lamp.

INDICATORS, Operation

Operation and Cost Indicators for Manager's Office.
Bristol Co., Waterbury, Conn. (Elapsed Time Recorder.)
Leeds & Northrup Co., 4901 Stenton Ave., Philadelphia, Pa.
Production Meter Co., 1315 S. Wabash Ave., Chicago, Ill.

INDUCTION COILS. See Coils, Finished.

INSTRUMENT, Jewels. See Jewels.

INSTRUMENTS, Laboratory Standard. See Instruments, Laboratory Standard.

INSTRUMENTS, Portable Testing. See Instruments, Portable and Switchboard; also Instruments, Pocket.

INSTRUMENTS, Laboratory Standard

Beck Bros., 3640 N. Second, Philadelphia, Pa.
Biddle, James G., 1211 Arch, Philadelphia, Pa.
Burt, R. C., 327 Michigan Ave., Pasadena, Cal. (Oscilloscopes.)
Cambridge Instrument Co., Ossining, N. Y.
Chicago Apparatus Co., 1735 N. Ashland Ave., Chicago, Ill.
Eppley Laboratory, Newport, R. I. (Standard Cells.)
Fahy. See Rubicon Co.
General Electric Co., Schenectady, N. Y.
Gray Instrument Co., 64½ W. Johnson, Philadelphia, Pa.
Hickok Elec'l Instrument Co., 10514 Dupont, Cleveland, O.
Jagabi. See Biddle, James G.
Jewell Elec. Instrument Co., 1650 Walnut, Chicago, Ill.
Kasson. See Rawson Elec'l. Instrument Co.
Kelvin. See Leeds & Northrup Co.
Kohlrausch. See Leeds & Northrup Co.
Leeds & Northrup Co., 4901 Stenton Ave., Philadelphia, Pa.
Milvay. See Chicago Apparatus Co.
Oslac. See Westinghouse Electric & Mfg. Co.
Pignolet Instrument Co., 76 Greenwich, New York, N. Y.
Rawson Elec'l Instrument Co., Cambridge, Mass.
Roller-Smith Co., 239 Broadway, New York, N. Y.
Rubicon Co., 29 N. Sixth, Philadelphia, Pa.
Simplex. See Leeds & Northrup Co.
Thompson-Levering Co., 351 N. 57th St., Philadelphia, Pa.
Yawter. See Thompson-Levering Co.
Unipivot. See Rawson Elec'l Inst. Co.
Vreeland Apparatus Co., 140 Cedar, New York, N. Y. (Sine Wave Oscillators.)
Westinghouse Electric & Mfg. Co., Newark, N. J.
Weston Elecl. Instrument Corp., 582 Frelinghuysen Ave., Newark, N. J.

INSTRUMENTS, Pocket

Advance. See Eldredge Elec'l Corp.
Adbro Mfg. Co., 927 French, Pittsburgh, Pa.
Eclipse. See Eldredge Elec'l Corp.
Eldredge Elec'l Corp., 3 P. O. Sq., Springfield, Mass.
Ideal Instrument Co., Penacook, N. H.
Jewell Elec. Instrument Co., 1650 Walnut, Chicago, Ill.
Kellogg Switchboard & Supply Co., 1066 W. Adams, Chicago, Ill.
Lundquist Tool & Mfg. Co., Worcester, Mass.
Manhattan Elec'l Supply Co., 17 Park Pl., New York, N. Y.
Millavolt. See Adbro Mfg. Co.
Readrite Meter Works, 7 College Ave., Bluffton, Ohio.
Roller-Smith Co., 239 Broadway, New York, N. Y.
Shire Elec. Products Co., Marquette Bldg., Detroit, Mich.
Sholder-Excel Mfg. Co., Clyde, Ohio.
Square D Company, Detroit, Mich.
Sterling Mfg. Co., 2831 Prospect Ave., Cleveland, Ohio.
Tiffany Mfg. Co., Newark, N. J.
Weston Elecl. Instrument Corp., 582 Frelinghuysen Ave., Newark, N. J.
Wigginton. See Square D Company.
Yankee. See Lundquist Tool Mfg. Co.

INSTRUMENTS, Portable and Switchboard

This heading includes all standard, portable and switchboard types, measuring and testing instruments—ammeters, voltmeters, wattmeters, ohmmeters, cable testers and fault-finders.

See Also Instruments, Pocket; Also Instruments, Laboratory Standard.

Beck Bros., 421 Sedgley Ave., Philadelphia, Pa.
Beede Instrument Co., 136 Liberty, New York, N. Y.
Biddle, James G., 1211 Arch, Philadelphia, Pa.
Brown Instrument Co., Wayne and Windrim Sts., Philadelphia, Pa.
Cambridge Instrument Co., Ossining, N. Y.
Dongan Electric Mfg. Co., 2985 Franklin, Detroit, Mich.
Eastern Specialty Co., 3551 N. Fifth, Philadelphia, Pa.
Electric Mfg. Co., 966 Mission, San Francisco, Cal.
Esterline-Angus Co., Speedway, Indianapolis, Ind.
Fidelity Electric Co., Lancaster, Pa.
Fisher Cable Test Sets. See Leeds & Northrup.
Fore Elecl. Mfg. Co., 5255 Wabada Ave., St. Louis, Mo.
Freyn Engrg. Co., 310 S. Michigan Ave., Chicago, Ill.
General Electric Co., Schenectady, N. Y.
Gray Instrument Co., 64½ W. Johnson, Philadelphia, Pa.
Ground-Ohmer. See Sticht & Co.
Handy. See Weinberg & Co.
Hickok Elecl. Inst. Co., 10514 Dupont, Cleveland, O.
Hoyt Elecl. Inst. Wks., 857 Boylston, Boston, Mass.
I T L. See Illinois Testing Laboratories.
Jaynes, R. F., Lynn, Mass.
Jewell Elec. Instrument Co., 1650 Walnut, Chicago, Ill.
Leeds & Northrup Co., 4901 Stenton Ave., Philadelphia, Pa.
Master. See Jewell Elecl. Instrument Co.
M. D. C. See Metropolitan Devices Corp.
Mazda Elec'l Supply Co., 870 Blue Island Ave., Chicago, Ill.
Megger Testing Sets. See Biddle.
Metropolitan Devices Corp., 1250 Atlantic Ave., Brooklyn
Multi-Volt Trouble Finder. See Welford, Jr., Geo. W.
Nazel Elecl. Co., W. G., 23 St. Clair, Toledo, Ohio.
Norton Elecl. Inst. Co., 81 Hilliard, Manchester, Conn.
Paneltest Meters. See Beede Instrument Co.
Peerless Meters. See Thompson-Levering Co.
Pier Equipment Mfg. Co., Benton Harbor, Mich.
Pignolet Instrument Co., 76 Greenwich, New York, N. Y.
Pin-Jack. See Weston Elec'l Instrument Co.
Price Hollister Co., Rockford, Ill.
Radio Electric Works, 150 West 22nd St., New York, N. Y.

A Standard of True Precision—

guides The Continental Fibre Company.

Makers of insulating materials for almost a quarter of a century, the firm is built upon the solid rock of a conscientious tradition of precision.

Adherence to a standard is often costly.

There have been times when the road to immediate profits seemed a compromise with expediency.

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A tradition of precision, deep rooted in our business structure, stands behind the enviable reputation held by The Continental Fibre Company today.

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New York . 250 Park Ave.
Chicago . . Wrigley Bldg.
San Francisco . 1575 Folsom St.
Los Angeles . 307 S. Hill St.
Seattle . 1520 Fourth Ave., So.

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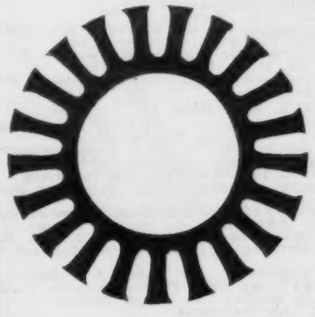


An Approved Laminated Electrical Insulation

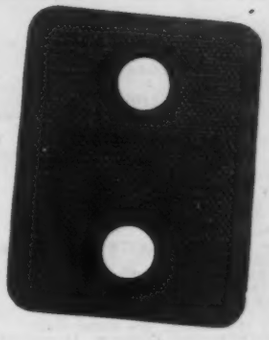
—and these characteristics will interest manufacturers who wish to cease experimenting with insulation:—

Dielectric strength—400-600 volts per Mil. Phase angle difference 1½% to 2%. Crushing strength approximately 36,000 pounds per square inch. Does not shatter. Does not deteriorate with age. Moisture absorption ½% in 24 hours. Weight about twenty cubic inches per pound. Specific gravity about 1.3. Unaffected by oil, grease or ordinary solvents. Individual samples have shown 1600 volts per Mil. under official and disinterested tests. Easily milled, turned, punched, sawed, stamped and threaded.

WILMINGTON FIBRE SPECIALTY CO.

Wilmington, Delaware

"WILMINGTON FIBRE" Sheets, Rods, Tubes and and Special Shapes



A sample?

—just say it on one of your letterheads

INSTRUMENTS—Continued
Rawson Elecl. Inst. Co., Cambridge, Mass.
Roller-Smith Co., 239 Broadway, New York, N. Y.
Sangamo Elec. Co., Springfield, Ill.
Shortfinder. See Eisemann Shortfinder Co.
Standee. See Sticht Co., H. H.
Sterling Mfg. Co., 2831 Prospect Ave., Cleveland, Ohio.
Sticht & Co., H. H., 13 Park Row, New York, N. Y.
Tanner Engrg. Co., Rawson St. and Nelson Ave., Long Island City, N. Y.
Test-A-Bat. See Beede Instrument Co.
Thompson-Levering Co., 351 N. 57th, Philadelphia, Pa.
Thomson. See General Electric Co.
Triplex Meters. See Roller-Smith Co.
3 in 1. See Sticht & Co., H. H.
Two-in-One. See Stitcht Co., Herman H.
United States Gauge Co., 44 Beaver, New York, N. Y.
Utility. See Esterline-Angus Co.
Westinghouse Electric & Mfg. Co., Newark, N. J.
Weston Elecl. Instrument Corp., 583 Frelinghuysen Ave., Newark, N. J.

INSULATION (Insulating) (Insulators)
Beads. See Beads, Insulating.
Canopy. See Insulators, Canopy.
Cloth. See Cloth & Paper.
Composition. See Molded Insulation.
Compound. See Wax and Comp.
Fibre. See Fibre.
Lava. See Cores, Resistance Coil.
Marble. See Slate.
Mica. See Mica.
Molded. See Molded Insulation.
Paint. See Paint and Varnish.
Paper. See Cloth and Paper Insulating.
Phenolic. See Fibre, Phenol. Also Molded Insulation.
Porcelain. See Porcelain.
Rod. See Rubber, Hard.
Rubber. See Rubber, Hard.
Sealing Wax. See Wax and Compounds.
Slate. See Slate.
Soapstone. See Soapstone.
Tubing. See Tubing, Varnished Fabrics.
Varnish. See Paint and Varnish.
Wax. See Wax and Compounds.

INSULATING MACHINES, WIRE. See Wire Manufacturing Machines.
INSULATING TUBING. See Tubing, Varnished Fabric; also Tubing, Rubber.

INSULATION CUTTERS
Artos Engrg. Co., Milwaukee, Wis.

INSULATION MIXERS
Baker Perkins Co., Saginaw, Mich.

INSULATION SHEARS. See Shears, Insulation.
INSULATION STRAINING MACHINES. See Wire Manufacturing Machines.
INSULATION TESTERS. See Instruments, Laboratory Standard.

INSULATORS, Canopy
Diamond State Fibre Co., Bridgeport, Pa.
General Electric Co., Schenectady, N. Y.
Knu. See Stanley, Arthur F.
Macallen Co., Macallen & Foundry, Boston, Mass.
Stanley, Arthur F. 150 Varick, New York, N. Y.
Wilmington Fibre Specialty Co., Wilmington, Del.

IRON CASTINGS. See Castings, Gray Iron.
IRONS, Soldering. See Soldering Irons.
JACKS, Armature. See Lifts, Armature.
JACKS, Radio. See Radio Receiver Parts.

JARS, Battery, Glass
For Composition Jars. See Molded Insulation; also Rubber.
Cumberland Glass Mfg. Co., Bridgeton, N. J.
Gaynor Glass Works, Salem, N. J.
Gillinder & Sons, Inc., Philadelphia, Pa.
Hazel-Atlas Glass Co., Wheeling, W. Va.
Macbeth-Evans Glass Co., Dept. G, Eastern Division, Charleroi, Pa.
Rodefer Glass Co., Bellaire, O.
Sneath Glass Co., Hartford City, Ind.
United States Glass Co., 9th & Bingham, Pittsburgh, Pa.

JEWELS, Instrument Bearing
Bird, Richard H., Waltham, Mass.
Deknatel & Sons, J. A., Queens Village, N. Y.
Eastern Specialty Co., 3551 N. Fifth, Philadelphia, Pa.
Fisher, Thomas E., Penacook N. H.
Gatti, Inc., Aurele M., Liberty St. & Fairmount Ave., Trenton, N. J.
Moser Jewel Co., Perth Amboy, N. J.
Mildrum Jewel Co., East Berlin, Conn.
Sapphire Products Co., 51 Chambers, New York, N. Y.
Wennstrom's Sons Co., John, Suffern, N. Y.
Worley Jewel Co., John, Waltham, Mass.
Universal. See Oefinger, J. L.

JOINTS, Fixture Insulating
Appleton Elec. Co., 1703 Wellington Ave., Chicago, Ill.
Macallen Co., Macallen & Foundry, Boston, Mass.
Sandow Tool Co., 1440 Broadway, New York, N. Y.
Sprecher Mfg. Co., P. W., 3220 North Ave., Milwaukee.
White Co., O. C., 15 Hermon, Worcester, Mass.
Wittenberg Bros., 60 Shipman, Newark, N. J.

LABORATORY (Laboratories.)
Ovens. See Ovens, Industrial & Laboratory.
Rheostats. See Rheostats.
Testing. See Testing.

LABORATORY STANDARD INSTRUMENTS. See Instruments, Laboratory Standard.

LACQUER, ARMATURE. See Paint, Varnish and Lacquer.
Metal. See Paint, Varnish and Lacquer.
LAMINATIONS. See Discs, Armature.
LAMP BASES. See Bases, Reading Lamp.
LAMP BULBS (Unfinished). See Bulbs, Glass.
LAMP FILAMENTS. See Filaments, Incandescent Lamp.
LAMP LEAD-IN WELDS. See Filaments, Incandescent Lamp.
LAMP TESTING PHOTOMETERS. See Photometers, Lamp Testing.

LATHES
(Special for use in Motor Repairing and Motor Mfg.—Test Bench Lathes).
Ajax Electric Co., Kalamazoo, Michigan.
Allen Electric & Equipment Co., Kalamazoo, Michigan.
Cincinnati Lathe & Tool Co., 3207 Disney (Oakley) Cincinnati, Ohio.
Hobart Bros. Company, Troy, Ohio. (Test Bench).
Weidenhoff, Joseph, 4352 W. Roosevelt Rd., Chicago, Ill.

LAVA. See Cores, Resistance Coil.
LEAD-IN WELDS, Lamp. See Filaments, Incandescent Lamp.
LEADS, FLEXIBLE (Commutator Brush). See Brushes, Commutator.

LENSES
Sign Letter, Flashlight, Projector and Reflector.
Bausch & Lomb Optical Co., 635 St. Paul, Rochester, N. Y. (Condensing and Projection Lenses.)
B. B. T. Corp. of America, Atlantic Bldg., Philadelphia, Pa.
Clinton Sign Co., Clinton, Ia.
Consolidated Lamp & Glass Co., Coraopolis, Pa. (Flashlight)

Corning Glass Wks, Corning, N. Y. (Flashlight and Signal.)
Deknatel & Sons, J. A., Queens Village, N. Y.
Gilligan Glass Products Co., New Philadelphia, Ohio.
Goerz American Optical Co., C. P., 317 E. 34th, New York.
Jefferson Glass Co., Follansbee, W. Va. (Sign and Flashlight.)
Kliegl Bros. Universal Stage Ltg. Co., 321 W. 50th, New York, N. Y. (Condensing and Projector.)
Macbeth Evans Glass Co., Dept. G, Eastern Division, Charlerol, Pa. (Flashlight.)
North Lights Co., 30 W. 15th, New York, N. Y.
Pyle National Co., 1334 N. Kostner Ave., Chicago, Ill.
Rochester Glass Products Co., 29 N. Water, Rochester, N. Y.
Rodefer Glass Co., Bellaire, O. (Flashlight.)
Sneath Glass Co., Hartford City, Ind. (Sign.)

LETTERS, Sign
Glass. Metal.
Addign Corp, 113 W. 63rd, New York, N. Y.
Chain Products Co., 3924 Cooper Ave., Cleveland, O. (Brass and White Metal.)
Chicago Miniature Lamp Co., 652 W. Lake, Chicago, Ill. (Raised Letters for Signs.)
Eradium. See Pioneer Corporation.
Federal Elec. Co., 8700 S. State, Chicago, Ill. (Metal.)
Grammes & Sons, Inc., L. F., Allentown, Pa.
Heralite. See Pressed Prism Plate Glass Co.
Kolux Glass Sales Co., Kokomo, Ind.
Lu-Mi-Nus Signs Inc., 2736 Wentworth Ave., Chicago, Ill.
Opalite Corp., 201 E. Ohio, Chicago, Ill.
Pioneer Corporation, 8308 Yale Ave., Chicago. (Luminous.)
Pressed Prism Plate Glass Co., Chicago, Ill. (Glass.)

LIFTS, Armature
Lifts, Hoists, Jacks, Trucks, Buggies, Floor Cranes.
Columbia Machine Works & Malleable Iron Co., Atlantic Ave. & Chestnut St., Brooklyn, N. Y.
Duff Mfg. Co., Pittsburgh, Pa.
Electric Service Supplies Co., 17th & Cambria Sts., Philadelphia, Pa.
Peerless. See Electric Service Supplies Co.
Ridion Company, Frank, Boston, Mass.

LININGS, Socket
Remington Mfg. Co., 937 Barnum Ave., Bridgeport, Conn.

LOCK WASHERS. See Washers, Lock.
LOOP WINDERS & SPREADERS. See Winding Machines, Armature & Field Coil.
LOUD SPEAKER DIAPHRAGMS MATERIAL. See Cloth, Untreated; also Parchment Paper.

LOUD SPEAKERS
Manufacturers Units and Electric Pick-ups for Portable and Built-in Types.
Air-Chrome. See Temple, Inc.
American Reproducer Corp., 55 W. 42nd, New York, N. Y.
A. R. C. See American Reproducer Corp.
Amplion. See Woolf, J. W. & W. L.
Balsa Wood Reproducer Corp., 331 Madison Ave., New York.
Bockman Radio Corp., 152 E. Seventh, S. Salt Lake City, Utah.
Brielle. See Penn Mfg. Co.
Brooklyn Metal Stamping Corp., 729 Atlantic Ave., Brooklyn, N. Y. (Electric Pick-up.)
Cannonball. See Cannon & Miller Co.
Cannon & Miller Co., Springwater, N. Y.
Chelten Electric Co., 4859 Stenton Ave., Philadelphia, Pa.
Dymac. See Electrical Products Mfg. Co.
Electrical Products Mfg. Co., Providence, R. I.
Electrical Research Laboratories, 2500 Cottage Grove Ave., Chicago, Ill. (Units.)
Empire United Hat Block Co., 312 E. 72nd, New York.
Engineers Service Co., 25 Church, New York, N. Y. (Kit.)
Ensco. See Engineers Service Co.
Fenco Cone Co., 57 Murray, New York, N. Y. (Kit.)
Fergus Co., 235 Elizabeth Ave., Newark, N. J.
G. R. P. See Penn Mfg. Co.
Grutal Speaker Co., 609 E. Walnut, Des Moines, Iowa.
Jensen Radio Mfg. Co., 333 N. Kedzie Ave., Chicago, Ill.
Lata Isalsa. See Balsa Wood Reproducer Corp.
Magnavox Co., 4250 Horton, Oakland, Cal. Also Units.
Markone Radio Mfg. Co., 303 Devoe, Brooklyn, N. Y. (Horn.)
Miles Mfg. Co., 191 Joralemon, Brooklyn, N. Y.
Minuet. See Thompson Radio Co.
Molded Wood Products. 219 W. Chicago Ave., Chicago, Ill.
Mozart-Radioceive. See Fergus Co.
Newcombe-Hawley, Inc., St. Charles, Ill.
Newton Elec'l Mfg. Co., Newton, Mass.
O'Neil Mfg. Corp., West New York, N. J.
Peerless. See United Radio Corp.
Penn Mfg. Co., G. R., 231 Mercer, New York, N. Y.
Philadelphia Storage Battery Co., Ontario & C Sts., Philadelphia, Pa.
Philco. See Philadelphia Storage Battery Co.
Platter Cabinet Co., North Vernon, Ind.
Powertone Elec. Co., 222 Fulton, New York, N. Y. (Kit.)
Purropower. See Platter Cabinet Co.
Racon Elec. Co., 18 Washington Place, New York, N. Y. (Horn only.)
Radio Cabinet Co., 2118 Gale, Indianapolis, Ind.
Raliotive Corp., 21st Ave. and 53rd, Brooklyn, N. Y.
Red Lion Cabinet Co., Red Lion, Pa.
Stromberg-Carlson Tel. Mfg. Co., 1060 University Ave., Rochester, N. Y.
Swchoda Co., Maritime Bldg., Seattle, Wash.
Teletone Corp. of America, Third St. & Van Alst Ave., Long Island City, N. Y.
Temple, Inc., 1925 S. Western Ave., Chicago, Ill.
Thompson Radio Co., 25 Church, New York, N. Y.
United Radio Corp., 25 Leighton Ave., Rochester, N. Y.
Universal. High Power Telephone Co., Carleton Ave. and Eddy, Seattle, Wash.
Utah Radio Products Co., 1615 S. Michigan Ave., Chicago, Ill. (Also Piano Unit.)
Victor Radio Corp., 4321 N. Western Ave., Chicago, Ill.
Vitalitone Radio Corp., 88 University Place, New York.
Wondrphone. See Universal High-Power Telephone Co.
Woolf J. W. & W. L., 227 Fulton, New York, N. Y.
Zisch Engineering Corp., Newark, N. J.

LUGS, Copper
Anderson Mfg. Co., Albert & J. M., 289 A St., Boston, Mass.
French Mfg. Co., Waterbury, Conn.
General Electric Co., Schenectady, N. Y.
Sherman Mfg. Co., H. B., Battle Creek, Mich.
Wolverine Tube Co., 1433 Central Ave., Detroit, Mich.

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Luminous Compound	See C
Pendants (Bulbs)	See P
Standard Parts	See S

Acornlite Studios, 675 72nd, Brooklyn, N. Y. ..... P
Arrow Electric Co., Hartford, Conn.
Bryant Electric Co., Bridgeport, Conn. ..... P
Connecticut Elec. Mfg. Co., Bridgeport, Conn. ..... S
Cutler-Hammer Mfg. Co., 1288 St. Paul Ave., Milwaukee, Wis.
Eagelite. See Eagle Elec. Mfg. Co.
Eagle Elec. Mfg. Co., 59 Hall, Brooklyn, N. Y. ..... P
General Electric Co., Merchandise Dept., Bridgeport, Conn. ..... S P
Glow Lite. See Rodale Mfg. Co.
Glow Tip. See Arrow Electric Co.
Hart & Hegeman Mfg. Co., Hartford, Conn. ..... S P
Hubbell, Inc., Harvey, Bridgeport, Conn. ..... P
Luma & Luma Lite. See Radium Dial Co.
Radieye. See General Electric Co.
Radium Dial Co., 3532 Forbes, Pittsburgh, Pa. .... C P
Reynolds Spring Co., Jackson, Mich. ..... S P
Rodale Mfg. Co., 200 Hudson, New York, N. Y. ..... P
Seelite. See T. C. Smith & Co.
Smith & Co., T. C., 3915 Powelton Ave., Philadelphia .. P
Spot O Life. See Hart & Hegeman Mfg. Co.
Undark. See United States Radium Corp.
United States Radium Corp., 535 Pearl, New York, N. Y. ..... C S P

MACHINE SCREWS. See Screws, Machine.
MACHINE SCREW PRODUCTS. See Screw Machine Products.

MACHINES
Armature Banding. See Banding Machines, Armature.
Armature Notching. See Notching Machines, Armature.
Balancing. See Balancers, Armature.
Banding. See Banding Machines, Armature.
Cable Armoring. See Wire Manufacturing Machines.
Coil Shaping. See Shaping Machines, Coil.
Coil Taping. See Taping Machines, Coil.
Coil Winding. See Winding Machines.
Commutator Slotting. See Mica Undercutters.
Engraving. See Engraving Machines.
Incandescent Lamp Making. See Machines, Lamp Making.
Molded Insulation. See Presses, Molded Insulation.
Perforating. See Perforating Machines.
Porcelain Molding. See Presses, Porcelain Molding.
Radio Tube. See Machines, Lamp Making.
Shaping. See Shaping Machines, Coil.
Slotting. See Mica Undercutters.
Soldering. See Soldering Machines, Commutator.
Spring Making. See Spring Making Machines.
Taping. See Taping Machines, Coil.
Tension. See Tension Machines, Band Wire.
Winding. See Winding Machines.
Wire, Armoring. See Wire Manufacturing Machines.
Wire Drawing. See Wire Drawing Machinery.
Wire Insulator. See Wire Manufacturing Machines.
Wire Measuring. See Wire Manufacturing Machines.
Wire Tension. See Tension Machines, Band Wire.
Wire Wrapping. See Wire Wrapping Machines.

MACHINES, Lamp Making
For Making Incandescent Lamps and Vacuum Tubes.
Arrow Mach. Co., 527 Hackensack Plank Rd., Union City, N. J.
Berrenberg, R., 12 Farnham (Roxbury), Boston, Mass (Vacuum Pumps.)
Dwyer Machine Co., Lynn, Mass.
Eisler Engineering Co., 770 S. 13th, Newark, N. J.
General Engineering & Supply Co., 160 5th Ave., New York, N. Y. Filament Winder.
Gesco. See General Engineering & Supply Co.
Sleeper & Hartley, Inc., Worcester, Mass.
York Elec. & Machine Co., 30 Penn, York, Pa.

MACHINES, Spring Making. See Spring Making Machines.
MACHINES, WIRE MANUFACTURING. See Wire Manufacturing Machines.
MAGNET CHARGERS. See Chargers, Magnet.
MAGNET STEEL. See Steel, Magnet.
MAGNET TESTERS. See Instruments, Portable and Switchboard; also Instruments, Pocket.
MAGNET WIRE MACHINES. See Enameling Machines for Magnet Wire.
MAGNETIC CHUCKS. See Chucks, Magnetic.
MAGNETIC CLUTCHES. See Clutches, Magnetic.
MAGNETOMETERS. See Instruments, Pocket.

MAGNETS, Permanent
Bullens Co., D. K., Pottstown, Pa.
Ind. Steel Products Co., 4545 S. Western Blvd., Chicago
Rogers Drop Forging Co., Worcester, Mass.
Stromberg-Carlson Tel. Mfg. Co., Rochester, N. Y.
Sticht & Co., H. H., 13 Park Row, New
Thomas & Skinner Steel Products Co., 1102 E. 23rd, Indianapolis, Ind.

MALLETS, Raw Hide
Chicago Rawhide Mfg. Co., 1313 Elston Ave., Chicago, Ill.
Crude Pelt. See Chicago Rawhide Mfg. Co.
Holbrook Raw Hide Mfg. Co., 748 N. Main, Providence, R. I.

MANGANESE, Battery. See Chemicals, Battery.
MEASURING INSTRUMENTS. See Instruments.
MECHANICAL RUBBER GOODS. See Rubber Mechanical Goods.
MEGOHMMETERS. See Instruments, Laboratory Standard.
MERCURY SWITCHES. See Switches, Mercury.
METAL CLEANERS (Compound). See Cleaners, Metal.
METAL CUTTING OUTFITS. See Welding and Cutting Outfits.
METAL FINISHING. See Plating & Finishing.
METAL MARKING OUTFITS. See Engraving Machines.
METALLIC SHADES. See Shades, Metallic.
METERS. See Instruments.
MICA SHADES. See Shades, Mica.
MICA TAPE. See Tape, Mica.
MICA UNDERCUTTERS. See Slotting Machines & Tools, Commutator.

MICA
Asheville Mica Co., Biltmore, N. C.
Asco. See Schoonmaker Insulation Co.
Brand & Co., Wm., 268 Fourth Ave., New York, N. Y.
Chicago Mica Co., Valparaiso, Ind.
Colonial Mica Co., 136 Seventh, Jersey City, N. J.
Dielectric Mfg. Co., St. Louis, Mo.
Fillion, S. O., 68 Murray, New York, N. Y.
Ford Radio & Mica Corp., 113 Bleecker, New York, N. Y.
Gerdau Co., Otto, 14 Lispenard, New York, N. Y.
Hirsch Mica Co. 1087 Flushing Ave., Brooklyn, N. Y.
Huse-Liberty Mica Co., 73 Long Wharf, Boston, Mass.
International Mica Co., 8860 Brandywine, Philadelphia, Pa.
Kant Krack. See Huse Liberty Mica Co.
Keene Mica Co., Keene, N. H.
Macallen Co., Macallen and Foundry, Boston, Mass.
Micabond. See Chicago Mica Co.
Mica Insulator Co., 200 Varick, New York, N. Y.
Mica Mfg. Co., 135 Johnson, Brooklyn, N. Y.
Micanite. See Mica Insulator Co.
Minerals & Insulation Co., 101 Spring, New York, N. Y
Mitchell-Rand Mfg. Co., 19 Vesey, New York, N. Y.
Miralite. See Mitchell-Rand Mfg. Co.

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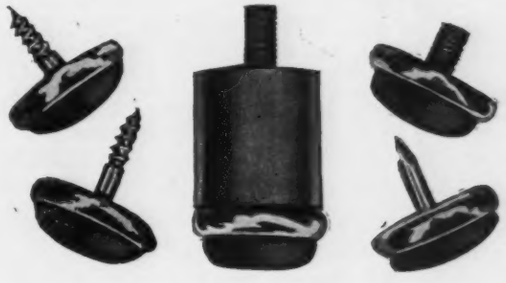

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New York Mica & Mfg. Co., Auburn, N. Y.
Peerless. See New England Mica Co.
Prestonite. See Robt. K. Preston Mica Co.
Preston Mica Co., Robt. K., 804 Monadnock Blk., Chicago. (Ground Mica.)
Red Streak. See Huse Liberty Mica Co.
Rogers-Pyatt Shellac Co., 81 Water St., New York. (Imp.)
Schoonmaker Insulation Co., A. O., 34 University Place, New York, N. Y.
Storrs Mica Co., 11 Park Place, New York, N. Y.
Tar Heel Mica Co. Plumtree, N. C.
Watson Bros., 170 Purchase, Boston, Mass.

MINIATURE SWITCHBOARD SYSTEMS. See Instruments, Portable and Switchboard.

MIXERS, INSULATION. See Insulation Mixers.

MOLDED
Presses. See Presses, Molded Insulation.
Radio Parts. See Radio Molded Parts.

MOLDED INSULATION

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Aiden Mfg. Co., Brockton, Mass.
Allen & Hills, Inc., Auburn, N. Y.
American Insulator Corp., 420 Lexington Ave., New York.
Amerine. See American Insulator Corp.
Anderson Mfg. Co., Albert & J. M., 289 A, Boston, Mass.
Asbestos Shingle Slate & Sheathing Co., Ambler, Pa. (Cold.)
Auburn Button Wks., Auburn, N. Y.
Bakelite Corp., 247 Park Ave., New York, N. Y.
Bay State Moulding Co., 1197 Dorchester Ave., Boston.
Belden Mfg. Co., 2310B S. Western Ave., Chicago, Ill.
Beldenmold. See Belden Mfg. Co.
Bell Mfg. Co., 11 Elkins, Boston, Mass. Radio Parts.
Boonton Molding Co., Boonton, N. J.
Boonton Rubber Mfg. Co., 223 Fanny Rd., Boonton, N. J.
Brewlite Moulding Corp., 109 Hudson, Jersey City, N. J. (Wood Composition.)
Coloron Co., Bridgeport, Pa.
Cetelite. See Connecticut Molded Products Corp.
Cetec. See Connecticut Molded Products Corp.
Cepco. See Connecticut Molded Products Corp.
Coltrock. See Colt's Patent Firearms Mfg. Co.
Charmond Elec. Corp., 30 Church, New York, N. Y.
Chicago Molded Products Co., 2149 Walnut, Chicago, Ill.
Cincinnati Molding Co., 2037 Florence Ave., Cincinnati, O.
Colasta Co., Hoosick Falls, N. Y.
Colt's Patent Fire Arms Mfg. Co., Hartford, Conn.
Compo-Site, Inc., 207 Astor, Newark, N. J.
Condensite. See Bakelite Corp.
Connecticut Elec. Mfg. Co., Bridgeport, Conn.
Connecticut Molded Products Corp., Meriden, Conn. (Cold.)
Cutler-Hammer Mfg. Co., 1288 St. Paul Ave., Milwaukee,
Dayton Insulating Molding Co., 434 E. First, Dayton, Ohio.
Diemoulding Production Co., Canastota, N. Y.
Dimec. See Dayton Insulating Moulding Co.
Durez. See General Plastics, Inc.
Electrose. See Insulation Mfg. Co.
Erinold Co., Park Row Bldg., New York, N. Y.
Evercool. See Bakelite Corp.
Federal Insulating Corp., Yonkers, N. Y.
Fedrelin. See Federal Insulating Corp.
Fenoline. See Insuline Corp. of America.
Formica Insulation Co., 4628 Spring Grove Ave., Cincinnati, O.
Garfield Mfg. Co., Garfield, N. J. Composition. (Cold.)
General Electric Co., Schenectady, N. Y.
General Moulded Composition Co., 212 Market, Lynn, Mass.
General Plastics, Inc., 96 Walck Rd., N. Tonawanda, N. Y.
Gummor. See Garfield Mfg. Co.
Hahn Mfg. Co., Harry W., 623 S. San Pedro, Los Angeles, Cal.
Herculite. See Colosta Co.
Huetter-Premier Machine Co., 7215 Livernois Ave., Detroit, Mich.
Hi-Heat. See Insulation Mfg. Co.
Hi-Tensit. See Boonton Rubber Mfg. Co.
Imperial Molded Products Co., 2925 W. Harrison, Chicago.
Improco. See Insulation Products Co.
Insulation Mfg. Co., New York Ave. and Herkimer St., Brooklyn, N. Y.
Insulation Products Co., 404 Richland, Pittsburgh, Pa.
Insuline Corp. of America, 78 Cortlandt, New York, N. Y.
International Insulating Corp., Elyria, O.
Isolantite Co. of America, Inc., Bellville, N. J.
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Kellite. See Kellogg Switchboard & Supply Co.
Kellogg Switchboard & Supply Co., 1066 W. Adams, Chicago, Ill.
Keystone Specialty Co., 2373½ Coventry Rd. (Lakewood), Cleveland, O.
Klagges, Chas., 128 147th, Ozone Park, N. Y.
Kuhn & Jacob Machine & Tool Co., 502 Prospect Ave., Trenton, N. J.
Kurz-Kasch Co., Dayton, O.
Lacanite. See Scranton Button Co.
Lavamix. See Splitdorf Radio Corp.
Macallan Co., Macallan and Foundry Sts., Boston, Mass.
Mack Molding Co., Little Falls, N. J.
Makalot. See Johnson Molding & Tool Co.
Manchester Mfg. Co., Manchester Depot, Vt.
Megobum. See Waterbury Button Co.
Micarta Fabricators, Inc., 309 Canal, New York, N. Y.
Micarta. See Westinghouse Elec. & Mfg. Co.
Modern Molded Products Co., Blount and Elm Sts., Providence, R. I.
New England Products Co., 232 Greenwich, New York, N. Y.
National Lead Co., 111 Broadway, New York, N. Y.
Niagara Insul-Bake Specialty Co., 483 Delaware Ave., Albany, N. Y.
Nixon Nitration Works, Nixon, N. J.
Nixonoid. See Nixon Nitration Works.
Noark. See Colt's Patent Fire Arms Mfg. Co.
Norloc. See Norton Laboratories, Inc.
Northern Industrial Chemical Co., 11 Elkin, South Boston.
Norton Laboratories, Inc., 1025 Mill, Lockport, N. Y.
Panelyte Co., Enterprise Ave., Trenton, N. J.
Paramix. See Splitdorf Radio Corp.
Paratherm. See Scranton Button Co.
Phenolic. See Scranton Button Co.
Pruven Composition Products Corp., Milford, Conn.
Pruvenite. See Pruven Composition Products Co.
Pyrolax. See Cutler-Hammer Mfg. Co.
Recto Mfg. Co., 23 W. 3rd, Cincinnati, O.
Redmonol. See Bakelite Corp.
Renlite. See Nixon Nitration Works.
Rexlite. See Northern Industrial Chemical Co.
Reynolds Spring Co., Jackson, Mich.
Reynoldite. See Reynolds Spring Co.
Reynomold. See Reynolds Spring Co.
Richardson Co., Lockland, Cincinnati, O.
Ridgelite. See Ridgley Trimmer Co.
Ridgley Trimmer Co., Springfield, O.
Schneider Bros., Inc., 504 N. Sheldon Ave., Chicago.
Scranton Button Co., Scranton, Pa.
Shaw Insulator Co., Irvington, Newark, N. J.
Siemon Co., State and Dewey, Bridgeport, Conn.
Specialty Insulation Mfg. Co., Hoosick Falls, N. Y.
Splitdorf Radio Corp., Newark, N. J.
Star Insulate. See Insulation Mfg. Co.
Starite. See Insulation Mfg. Co.
Stokes & Smith Co., Summerdale Ave. near Roosevelt Blvd., Philadelphia, Pa.
Synamix. See Garfield Mfg. Co.
Textolite. See General Elec. Co.
Thermoplax. See Cutler-Hammer Mfg. Co.
Tegit. See Garfield Mfg. Co.
Union Insulating Co., Parkersburg, W. Va.
Vulcabeston. See Colt's Patent Fire Arms Mfg. Co.
Vulcanized Rubber Co., 251 Fourth Ave., New York, N. Y.
Waterbury Button Co., Waterbury, Conn.
Watertown Mfg. Co., Watertown, Conn.
Westinghouse Elec. & Mfg. Co., East Pittsburgh, Pa.

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Elkon, Inc. (Div. of P. R. Mallory Co.), Portchester, N. Y.
Lohfeld & Co., J. L., 53 Park Place., New York, N. Y.
Palatine Industrial Co., 111 Fifth Ave., New York, N. Y.
Radiotherma, Inc., 45 E. 17th, New York, N. Y.

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MOTOR CONTROLLERS. See Controllers, Motor.
MOTOR PLATFORM BASES. See Bases, Motor Platform.
MOTOR STARTERS. See Controllers, Motor; Switches, Remote Control; Switches, Motor Starting; Safety; Switches, Snap (Heavy Duty).

MOTORS

Alternating Current	See S				
Direct Current	See S				
Motors, 1 Hp. up	See M				
Motors Fractional Hp.	See F				
Universal	See U				
Acme Elec. & Mfg. Co., 1652 Rockwell, Cleveland	M				
Actodector. See Roth Bros. & Co.					
Advance Elec. Co., 4311 Maple Ave., St. Louis	M	F	S		
Allis-Chalmers Mfg. Co., Milwaukee, Wis.	M		S		
Allis Co., Louis, Milwaukee, Wis.	M		S		
American Brown Boveri Elec. Corp., Graybar Bldg., New York, N. Y.	M		S		
American Elec. Motor Co., Cedarburg, Wis.	M				
Apex Elec'l Mfg. Co., 1067 E. 152nd, Cleveland		F	S	U	
Armor Elec. Mfg. Co., 1020 Holland, Erie, Pa.	M				
A. R. S. See Westinghouse Elec.					
Baldor Elec. Co., 4352 Duncan Ave., St. Louis	M	F	S		
B-Line. See Brown-Breckmeyer Co.					
Bodine Elec. Co., 2254 Ohio, Chicago		F	S	U	
Bogue Elec. Co., Chas. J., 132 King, New York	M				
Brown-Brockmeyer Co., Norwood Power Bldg., Dayton, O.	M	F			
Burke Elec. Co., Erie, Pa.	M	F	S	U	
B. T. See Allis Co., Louis.					
B & R Mfg. Co., 812 Lafayette, Toledo, O.		F			
Cah. See Westinghouse Elec. Mfg. Co.					
Century Elec. Co., 1806 Pine, St. Louis, Mo.	M	F	S		
Chandeysson Elec. Co., St. Louis, Mo.	M		S		
Clark, Jr., Elec. Co., James, 600 E. Bergman, Louisville, Ky.	M				
Cleveland Armature Wks., 4732 St. Clair Ave., Cleveland, O.	M		S		
Comet Elec. Co., 47 Union Trust Bldg., Indianapolis, Ind.					
Crocker-Wheeler Elec. Mfg. Co., Ampere, N. J.	M		S	U	
Cushman Elec. Co., Concord N. H.	M	F	S		
Day-Fan Electric Co., Dept. A, Dayton, O.		F	S		
Diehl Mfg. Co., Elizabeth, N. J.	M	F	S		
Diverter Pole. See Rochester Elec. Product Co.					
Domestic Electric Co., 7209 St. Clair Ave., Cleveland, O.				S	U
Dumore. See Wisconsin Elec. Co.					
Eclipse. See Fidelity Elec. Co.					
Electric Machinery Co., Minneapolis, Minn.	M		S		

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Electric Specialty Co., 221 South Stamford, Conn.	M	F	S	U
Electro-Dynamic Co., Bayonne, N. J.	M		S	
Emerson Electric Mfg. Co., 2014 Washington Ave., St. Louis, Mo.	M	F	S	U
Engberg's Elec. & Mechl. Works, St. Joseph, Mich.	M		S	
Esco. See Electric Specialty Co.				
Fairbanks-Morse & Co., Chicago, Ill.	M	F		
Fidelity Elec. Co., Lancaster, Pa.	M	F	S	U
Fitzgerald Mfg. Co., Torrington, Conn.		F		
Fynn Weichsel. See Wagner Elec. Corp.				
Galvin Elec. Mfg. Co., 3314 S. Broadway, St. Louis, Mo.		F	S	
General Elec. Co., Schenectady, N. Y.	M	F	S	U
Gilbert Co., A. C., New Haven, Conn.		F		U
Hamilton Beach Mfg. Co., Racine, Wis.		F	S	U
Hobart Bros. Co., Troy, O.	M		S	
Holtzer-Cabot Elec. Co., 125 Amory, Boston	M	F	S	
Howell Elec. Motors Co., Howell, Mich.	M		S	
Ideal Elec. & Mfg. Co., Mansfield, O.	M		S	
Imperial Electric Co., Akron, O.	M		S	
Janette Mfg. Co., 556 W. Monroe, Chicago		F	S	
Jantz & Leist Elec. Co., Cincinnati, O.	M	F		
Jeanin Electric Co., Toledo, O.		F	S	
Kendrick & Davis Co., Lebanon, N. H.		F	S	
Kimble Elec. Co., 634 N. Western Ave., Chicago	M		S	U
Knapp Elec., Inc. (Div. of P. R. Mallory & Co.), Port Chester, N. Y.		F	S	U
Leland Elec. Co., Dayton, O.		F	S	
L. E. See Leland Elec. Co.				
Lincoln Elec. Co., Cleveland, Ohio	M		S	
Linc-Weld. See Lincoln Elec. Co.				
Linzee Elec. Motor Co., Mansfield, O.	M			
Mando Co., Syracuse, N. Y.		F		
Marathon Elec. Mfg. Co., 32 Island, Wausau, Wis.		F		
Marble-Card Elec. Co., Gladstone, Mich.	M			
Master Electric Co., Linden and Master Aves., Dayton, O.	M	F	S	
MC. See General Electric Co.				
Metergram. See Bodine Elec. Co.				
Michigan Elec. & Mfg. Co., Lake Linden, Mich.		F	S	
N. C. See Electric Controller & Mfg. Co.				
Norfolk. See Walter Elec. Mfg. Co.				
North East Elec. Co., Rochester, N. Y.		F		U
Northwestern Mfg. Co., 480 Clinton, Milwaukee	M			
Ohio Elec. & Controller Co., 5905 Maurice Ave., Cleveland, Ohio		F	S	
O. K. See Marathon Elec. Mfg. Co.				
Osann Co., F., 245 Seventh Ave., New York	M			
Pan. See Chandeysson Elec. Co.				
Peerless Elec. Co., 740 W. Market St., Warren, O.	M	F	S	U
Polar Cub. See Gilbert Co., A. C.				
Pow-R-Full. See Wagner Elec. Corp.				
Ra-Lite. See Acme Elec. & Mfg. Co.				
Reco. See Reynolds Electric Co.				
Red Band. See Howell Elec. Motors Co.				
Reliance Elec. & Engrg. Co., 1042 Ivanhoe Rd., Cleveland, O.	M		S	
Reynolds Electric Co., 2650 W. Congress, Chicago		F	S	
Robbins & Myers, Inc., Springfield, O.	M	F	S	U
Rochester Elec Products Corp., Rochester, N. Y.	M		S	
Rotator. See Bodine Elec. Co.				
Roth Bros. & Co., Chicago, Ill.	M		S	
Standard. See Robbins & Myers Co.				
Star Elec. Motor Co., Miller St. & N. J. R. R. Ave., Newark, N. J.	M		S	
Sterling Elec. Motors, Inc., Telegraph Rd. and Atlantic Blvd., Los Angeles, Cal.	M		S	
Stow Mfg. Co., Binghamton, N. Y.	M	F	S	U
Sturtevant Co., Boston, Mass.	M	F	S	U
Sunlight Electrical Mfg. Co., Warren, O.		F	S	
Super Wick. See Master Elec. Co.				
Switch start. See Lincoln Elec. Co.				
Triumph Elec. Corp., Carthage, O.	M		S	
Union Elec. Motor Mfg. Co., Hancock & Oxford Sts., Philadelphia, Pa.	M	F	S	
U. S. Elec. Mfg. Co., 200 E. Slawson Ave., Los Angeles	M		S	
Usemco. See U. S. Elec Mfg. Co.				
Valley Elec. Co., 4221 Forest Park Blvd., St. Louis, Mo.	M		S	
Wagner Elec. Corp., 6400 Plymouth Ave., St. Louis, Mo.	M	F	S	U
Walter Elec. Mfg. Co., Norfolk, Va.	M		S	
Watson. See Allis Co., Louis.				
Welco Uniframe. See Wesche Elec. Co., B. A.				
Wesche Elec. Co., B. A., 1622 Vine, Cincinnati	M	F	S	

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Woods Mach. Co., S. A., Boston..... M F S ..
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Angell Embossing Co., 37 Barney-Smith Co., Dayton, O.
Celoron Co., Bridgeport, Pa.
Chandler Co., Springfield, Mass.
Crowe Name Plate & Mfg. Co., 1749 Grace, Chicago, Ill.
Electro-Chemical Engraving Co., 52 Vanderbilt Ave., New York, N. Y.
Etched Products Corp., 90 Tenth, Long Island City, N. Y.
Etching Co. of America, 1539 Montana, Chicago, Ill.
General Etching & Mfg. Co., 3070 W. Grand Ave., Chicago, Ill.
Grammes & Sons Inc., L. F., Allentown, Pa.
Premier Metal Etching Co., 14th & Van Alst Ave., Long Island City, N. J.
Waterbury Button Co., Waterbury, Conn.

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American Mond Nickel Co., Century Bldg., Pittsburgh, Pa.
Driver-Harris Co., Harrison, N. J.
International Nickel Co., 67 Wall, New York, N. Y.
Seymour Mfg. Co., Seymour, Conn.
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OSCILLOSCOPES. See Instruments, Laboratory Standard.

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Freas. See Thermo Elec. Instrument Co.
Gehnrich Indirect Heat Oven Co., Long Island City, N. Y.
General Electric Co., Schenectady, N. Y.
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Heidbrink Co., 2633 Fourth Ave., S., Minneapolis, Minn.
Hynes & Cox Elec. Corp., 406 N. Pearl, Albany, N. Y.
Kenworthy, Chas. F., 108 Piedmont, Waterbury, Conn.
Machler Co., Paul, 2210 Lake, Chicago, Ill.
Milho Co., 717 Sycamore, Cincinnati, O.
Radio Elec'l Wks., 150 W. 22nd, New York, N. Y.
Sargent & Co., E. H., Chicago, Ill.
Sioux Battery & Mfg. Co., Sioux City, Ia. (Battery.)
Snead & Co., Jersey City, N. J.
Standard Elec. Stove Co., Toledo, Ohio.
Steiner & Co., E. E., 197 E. Kinney St., Newark, N. J.
Stokes Machine Co., F. J., 5826 Tabor Rd., Philadelphia, Pa.
Swartwout Co., 18522 Euclid Ave., Cleveland, O.
Thermo Elec. Instrument Co., 1206 Grove, Irvington, N. J.
Westinghouse Elec. & Mfg. Co., Mansfield, O.
Young Bros. Co., 6500 Mack, Detroit, Mich.

OXIDES, Battery. See Chemicals, Battery.

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Federal Metallic Packing Co., Wakefield, Mass.
Packtite. See Federal Metallic Packing Co.

PAINT, Varnish, Lacquer

KEY
Varnishes, Insulating .....See V
Painting, Dipping, Spraying, Vacuum Impregnating.
Paint, Insulating and Acid Proof..See P
Lacquer, Metal Finishing .....See L

Acme White Lead & Color Wks., 8250 St. Aubin Ave., Detroit, Mich. L
Acme Wire Co., New Haven, Conn. V
Ajax. See Sherwin-Williams Co.
Alaka. See Lacquer & Chemical Corp.
American Di-Electrics, Ltd., Hancock and Bodine, Long Island City, N. Y. V
American Lastite Co., 3166 Lincoln Ave., Chicago.. .. P L
Antakwa Co., 1329 Mohawk, Chicago, Ill. ..... P
Apexior. See Dampney Co. of America
Arizona Lacquer Mfg. Co., 7 16th, Brooklyn, N. Y. L
Armlac. See Robertson Chemical Co.
Arolac. See Arizona Lacquer Mfg. Co.
Art-O-Craft. See Southwestern Paint & Varnish Co.
Atlantic Chemical Co., Coit, Irvington, N. J..... L
Atom Chemical Co., 96 E. 10th, New York, N. Y.. .. L
Baleilite Corp., 147 Park Ave., New York, N. Y.. .. L
Belden Mfg. Co., 2310B, S. Western Ave., Chicago

Benolite Varnish Co., 501 Columbia Bank Bldg., Pittsburgh ..... V P ..
Berry Bros., Leib & Wight, Detroit, Mich..... V .. ..
Billings-Chapin Co., 1163 E. 40th, Cleveland, O.. V .. ..
Biwax Corp., 208 S. La Salle, Chicago, Ill..... .. P ..
Bradley-Hurtz Co., 2626 S. Dearborn, Chicago, Ill. L
Brevolite. See Waukegan Chemical Co.
Calman & Co., Emil, 42 Vernon Blvd., Long Island City, N. Y. ..... V P ..
Carboloid Products Corp., 15 Park Row, New York, V P ..
Chinalac. See Dolph Co., John C.
Cochrane Chemical Co., 432 Danforth Ave., Jersey City, N. J. ..... V P ..
Code 25. See Mitchell-Rand Mfg. Co.
Columbus Varnish Co., 264 Cozzeins, Columbus, O. V .. ..
Comulac. See Martindale Elec. Co.
Dampney Co. of America, Boston, Mass..... V .. ..
Dolph Co., John C., 168 Emmet, Newark, N. J.. V P ..
Duco. See Du Pont de Nemours & Co.
Du Pont de Nemours & Co., Wilmington, Del.... P ..
Eastman Kodak Co., Rochester, N. Y..... L
Eclipse Paint & Mfg. Co., Cleveland, O..... .. P ..
E. B. See Mitchell-Rand Mfg. Co.
Egyptian Lacquer Mfg. Co., 90 West, New York.. L
Electric Lacquer. See Dolph Co., John C.
Enamelac. See Robertson Chemical Co.
Ever-Brite Products Co., East Liverpool, O..... L
Federal Insulating Corp., Yonkers, N. Y..... V P ..
Flex-ib-lac. See Dielectric Mfg. Co.
Franche & Co., 440 Orleans, Chicago, Ill..... L
General Elec. Co., Mda. Dept. Bridgeport, Conn.. V P ..
General Plastics, Inc., 96 Walck Rd., N. Tonawanda, N. Y. ..... V .. ..
George Co., P. D., St. Louis, Mo..... V .. ..
G. E. See General Elec. Co.
Glidden Co., Cleveland, O..... V P L
H. B. See Maas & Waldstein Co.
Hilo Varnish Corp., Marcy & Flushing Aves., Brooklyn, N. Y. ..... V P L
Impervious Varnish Corp., 421 Wood, Pittsburgh. V P ..
Insulaterite. See Ohmlac Paint & Refining Co.
Insulvar. See Varflex Corp.
Irvington Varnish & Insulator Co., Irvington, N. J. V P L
Kodalak. See Eastman Kodak Co.
Krakles. See Waukegan Chemical Co.
Lacquer & Chemical Corp., 214-40th St., Brooklyn, N. Y. .... P L
Laqueroid. See Glidden Co.
Liberty. See Antakwa Co.
Linolac. See Mica Insulator Co.
Lowe Bros. & Co., 450 E. 3rd, Dayton, O..... V P ..
Lucas & Co., John, 322 Race, Philadelphia, Pa.. V P ..
Lucote. See Lucas & Co., John.
Maas & Waldstein, 438 Riverside Ave., Newark, N. J. L
McDougall-Butler Co., Inc., Evans Water & Norton, Buffalo, N. Y. ..... V P ..
Martindale Elec. Co., 1262 W. Fourth, Cleveland, O. ..... V .. ..
Mawalac. See Maas & Waldstein.
Mecco. See Henry V. Walker Co.
Mica Insulator Co., 200 Varick St., New York.... V .. ..
M. I. C. See Mica Insulator Co.
Mitchell-Rand Mfg. Co., 19 Vesey, New York, N. Y. V P ..
Nikolas & Co., G. J., 1237 W. Van Buren, Chicago. L
O'Brien Varnish Co., South Bend, Ind..... V P L
Ohmlac Paint & Refining Co., 140 S. Dearborn, Chicago, Ill. .... P ..
Opex. See Sherwin-Williams Co.
Ozite. See Standard Underground Cable Co.
P. & B. See Ruberoid Co.
Pacoria Paint Co., 4th & Sedgeley Ave., Philadelphia, Pa. L
Pedigree. See George Co., P. D.
Peninsular Paint & Varnish Co., Detroit, Mich. L
Peerless. See Maas & Waldstein Co.
Proxlin. See Acme White Lead & Color Wks.
Pruett-Schaeffer Chemical Co., Taber, Pittsburgh. .. P L
Reliable Leather Dressing Co., 43 Crescent, Long Island City, N. Y. ..... V .. ..
Republic Varnish Co., 200 Thomas, Newark, N. J. V .. ..
Robertson Chemical Co., 9805 Meech Ave., Cleveland, O. ..... V P ..
Rockbestine. See Rockbestos Products Corp.
Rockbestos Products Corp., New Haven, Conn.
Rockbestos Products Corp., Nicoll & Conner Sts., New Haven, Conn. ....
S. P. C. See Ruberoid Co.
Schenectady Varnish Co., Schenectady, N. Y..... V P ..
Sherwin-Williams Co., Cleveland, O..... V P L
Sips & Co., James B., Chamber of Commerce Bldg., Pittsburgh, Pa. L
Southwestern Paint & Varnish Co., 610 Broadway, Kansas City, Mo. ..... V P ..
Standard Flexible Comp. Co., Franklin Trust Bldg., Philadelphia, Pa. ..... V P ..
Standard Insulation Co., Rutherford, N. J..... V .. ..
Standard Lacquer Co., 621 Broadway, New York, N. Y. L
Standard Underground Cable Co., Div. of General Cable Corp., Pittsburgh, Pa..... .. P ..
Standard Varnish Wks., 443 4th Ave., New York. V P L
Sterling Varnish Co., Haysville, Pa..... V .. ..
Toch Bros., 443 4th Ave., New York..... V P L
Truscon Laboratories, Canift & Grand Trunk Railway, Detroit, Mich. ..... V .. ..
2098. See Mitchell-Rand Mfg. Co.
Varflex Corp., Rome, N. Y..... V .. ..
Voltex Co., 99 Reservoir Ave., Bridgeport, Conn. V P ..
Vulcan-Lastite. See American Lastite Co.
Walker Co., Henry V., 17 John St., New York..... L
Walpole. See Robertson Chemical Co.
Waukegan Chemical Co., North Chicago, Ill..... L
Westinghouse Elec. & Mfg. Co., E. Pittsburgh, Pa. V P ..
Zapon Co., Stamford, Conn. L
Zellac. See Zeller Lacquer Mfg. Co.
Zeller Lacquer Mfg. Co., 20 E. 49th, New York. L

PANELS (panel) Engraving. See Engraving.
Radio (Metal). See Radio Mountings.
Radio (Molded). See Radio Molded Parts.
Radio (Hard Rubber) See Rubber Hard.
Meters. See Instruments, Portable & Switchboard.

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Boxes. See Boxes & Wrappers.
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Candles. See Candles, Fixture.
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Special Paper Mfg. Co., 96 Reade, New York, N. Y.
Strype, Fred C., 140 Lafayette, New York, N. Y.
Taylor-Logan Co., Holyoke, Mass.
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Gilbert Supply Co., Independence, Iowa.
Little Speedster. See Gilbert Supply Co.
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Scovil Mfg. Co., Waterbury, Conn.

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Foto Cell. See Raytheon Mfg. Co.
General Electric Co., Schenectady, N. Y.
Kino-Lamp. See Raytheon Mfg. Co.
Photion Instrument Corp., 574 Southern Blvd., New York.
Radio Elec'l Wks., 150 W. 22nd, New York, N. Y.
Raytheon Mfg. Co., Cambridge, Mass.
Westinghouse Elec. & Mfg. Co., Mansfield, Ohio.

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Foote, Pierson & Co., 160 Duane, New York, N. Y.
Gray Instrument Co., 64½ W. Johnson, Philadelphia, Pa.
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PINION PULLERS. See Pullers, Armature Shaft.

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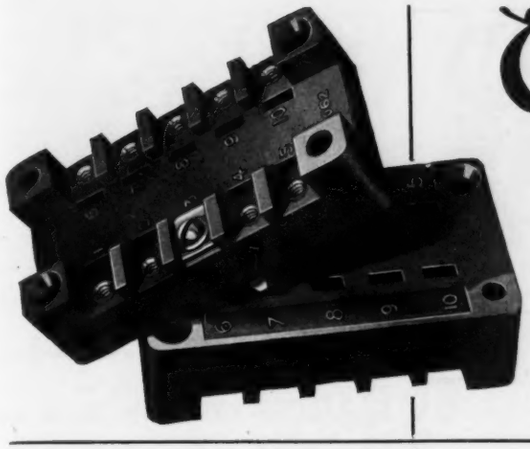

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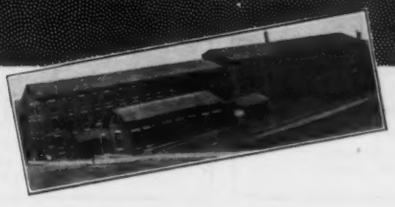

Auburn Plant, Auburn, New York

Plates, Storage Battery—Continued
Englert Mfg. Co., 2500 Jane, Pittsburgh, Pa.
Esto. See New Jersey Storage Battery Co.
Fort Wayne Battery Mfg. Co., 230 E. Fourth, Ft. Wayne.
Handler. See Witherbee Storage Battery Co.
Link & Hemrick, Inc., 555 W. 52nd St., New York, N. Y.
New Jersey Storage Battery Co., 656 Summit Ave., Union City, N. J.
Universal Battery Co., 3410 S. La Salle, Chicago, Ill.
Witherbee Storage Battery Co., 75 Columbus Ave., New York.

PLATING GENERATORS

American Giant. See Connecticut Dynamo Motor Co.
Bogue Elec. Co., Chas. J., 132 King, New York, N. Y.
Burke Elec. Co., Erie, Pa.
Chandeysson Elec. Co., St. Louis, Mo.
Connecticut Dynamoz Motor Co., Irvington, N. J.
Conpro. See Eager Elec. Co.
Eager Electric Co., 522 Nevell, Watertown, N. Y.
Eclipse. See Fidelity Elec. Co.
Electric Specialty Co., 229 South, Stamford, Conn.
Esco. See Electric Speciality Co.
Fidelity Elec. Co., Lancaster, Pa.
Hanson-Van Winkle-Munning Co., Matawan, N. J.
Hobart Bros. Co., Troy, O.
Holtzer-Cabot Elec. Co., 125 Amory, Boston, Mass.
Ideal Electric & Mfg. Co., East Third St., Mansfield, O.
Janiz & Feist Elec. Co., Cincinnati, O.
Kendrick & Davis Co., Lebanon, N. H.
L'Hommedieu & Sons Co., Chas. F., 4521 Ogden Ave., Chicago Ill.
Optimus. See Hanson-Van Winkle & Munning Co.
Pan. See Chandeysson Elec. Co.
Reliance. See L'Hommedieu & Sons Co., Chas. F.
Roth Bros. & Co., Chicago, Ill.
Westinghouse Elec. Mfg. Co., East Pittsburgh, Pa.

PLATING AND FINISHING

Chromium Plating, Rust Proofing and other special metal-finishing processes.
Amalog. See American Machine & Foundry Co.
American Machine & Foundry Co., 511 Fifth Ave., New York, N. Y.
American Nickeloid Co., Peru, Ind.
Atlantic Chemical Co., Colt, Irvington, N. J.
Duro Chrome. See General Chromium Corp.
General Chromium Corp., 3220 Bellevue Ave., Detroit, Mich. (Chromium Plate.)
Parker Rust-Proof Co., 2177 E. Milwaukee, Detroit, Mich.
United Chromium, 30 E. 42nd, New York, N. Y.
Uchlite Process Co., 3220 Bellevue Ave., Detroit, Mich. (Rust-Proof Finish.)

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American Platinum Wks., 241 New Jersey Railroad Ave., Newark, N. J.
Baker & Co. Inc., 54 Austin, Newark, N. J.
Coffin Mfg. Co., B. F., 30 Court, Newark, N. J.
Interstate Products Corp., 29 Commercial, Newark, N. J.
R. & H. Platinum Works, 709 Sixth Ave., New York.
Wilco. See H. A. Wilson Co.
Wildberg Bros., Smelting & Refining Co., 742 Market, San Francisco, Cal.
Wilson Co., H. A., 97 Chestnut, Newark, N. J.

PLUG FUSES. See Fuses and Fuse Wire.
PLUG RECEPTACLES. See Receptacles, Plug.
PLUGS, Flashing. See Flashers, Sign.
PLUGS, Radio. See Radio Receiver Parts.

PLUGS, Attachment

A-1 Bakelite. See Connecticut Elec. Mfg. Co.
Ajax Elec. Specialty Co., 1926 Chestnut, St. Louis, Mo.
Alcor Mfg. Co., 4605 W. Madison, Chicago.
Anselite Elec. Mfg. Co., New Haven, Conn.
Anylite Elec. Co., Fort Wayne, Ind.
Arrow Elec. Co., Hartford, Conn.
Arro-Grip. See Arrow Elec. Co.
Beardsley & Wolcott Mfg. Co., Waterbury, Conn.
Beaver Mfg. Co., 625 N. Third, Newark, N. J.
Bee-Ell Elec. Mfg. Co., 79 Mercer, New York, N. Y.
Belden Mfg. Co., 2310 B. S. Western Ave., Chicago, Ill. (Special Soft Rubber Plug Furnished with Belden Cords).
Benjamin Elec. Mfg. Co., 120 S. Sangamon, Chicago, Ill.
Bryant Elec. Co., Bridgeport.
C. H. See Cutler-Hammer Mfg. Co.
Carling Tool & Machine Co., 33 Union Place, Hartford, Conn.
Cemco. See Connecticut Elec. Mfg. Co.
Cetelite. See Connecticut Moulded Products.
Circle F Mfg. Co., Trenton, N. J.
Colts Patent Fire Arms Mfg. Co., Hartford, Conn.
Connecticut Elec. Mfg. Co., Bridgeport, Conn.
Connecticut Moulded Products Corp., Meriden, Conn.
Consolidated Gas Iron Co., 32 Union Square, New York.
Cutler-Hammer Mfg. Co., 1288 St. Paul Ave., Milwaukee.
Diamond, H. See Hart Mfg. Co.
Dreadnaught. See Cutler-Hammer Mfg. Co.
Eagle Elec. Mfg. Co., Dept. ER4, 50 Hall, Brooklyn, N. Y.
Eastman Mfg. Co., Manitowoc, Wis.
Electric Co., 94 Allyn, Hartford, Conn.
Ericson Mfg. Co., 3257 Bradford Rd., Cleveland, O.
Esler Elec. Mfg. Co., 802 S. Adams, Marion, Ind.
Fefco Products Co., 124 S. Calvert, Baltimore, Md.
Fitzall. See Rodale Mfg. Co.
Gaynor Elec. Co., Inc., Stratford Ave., Bridgeport, Conn.
General Elec. Co., Bridgeport, Conn.
Globe Metal Mfg. Co., 2122 E. Hazzard, Philadelphia, Pa.
Gold Seal Elec. Co., 250 Park Ave., New York, N. Y.
Gripall. See Beaver Mfg. Co.
Handle Cap. See Beaver Mfg. Co.
Hart Mfg. Co., Hartford, Conn.
Hart & Hegeman Mfg. Co., Hartford, Conn.
Hectach. See Marks Products Co.
Hemco. See Bryant Electric Co.
Hoosick Falls Radio & Electrical Parts Mfg. Co., Hoosick Falls, N. Y.
H. & H. See Hart & Hegeman Mfg. Co.
Hubbell, Inc., Harvey, Bridgeport, Conn.
Imperial. See Consolidated Gas Iron Co.
Iona Co., Los Angeles, Cal.
Leviton Mfg. Co., 226 Newell, Brooklyn, N. Y.
Jiffy. See Esler Elec. Mfg. Co.
Marks Products Co., 23 E. 16th, New York.
Metropolitan Electric Mfg. Co., Blvd. at 14th St., Long Island City, N. Y.
Nelco. See Nelson Elec. Co.
Nelson Elec. Co., Plant City, Fla.
P. & S. See Pass & Seymour.
Paragon Elec. Sales Co., 215 S. Fifth, Philadelphia, Pa.
Pass & Seymour, Solvay Sta., Syracuse, N. Y.

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Real. See Smith & Co., T. C.
Real Diamond. See Smith & Co., T. C.
Reben Electric Mfg. Co., 2024 Gravesend Ave., Brooklyn, N. Y.
Remco. See Reben Elec. Mfg. Co.
Reynolds Spring Co., Jackson, Mich.
Reynolite Masterpiece. See Reynolds Spring Co.
Ripple. See Bryant Elec. Co.
Rodale Mfg. Co., 200 Hudson, New York.
Safegard Elec. Appliance Co., 1015 Chestnut, Philadelphia, Pa.
Samson Cutlery Co., 8 Jones, Rochester, N. Y.
Sears, Henry D., 80 Boylston, Boston 11, Mass.
Smith & Co., T. C., 3915 Powelton Ave., Philadelphia, Pa.
Snapit. See Marks Products Co.
Snoco. See Snow & Co., E. W.
Snow & Co., E. W., Rochester, N. Y.
Spartanette. See Bryant Elec. Co.
Spar Tap. See Bryant Elec. Co.
Speedway Elec. Mfg. Co., 30 Church, New York, N. Y.
Standard. See Cutler-Hammer Mfg. Co.
Suitmall. See Beaver Mfg. Co.
Surefit. See Alcor Mfg. Co.
T. E. C. See Electric Co.
Tedco. See Paragon Elec. Sales Co.
Telltale Tap. See General Elec. Co.
Templus. See Bryant Elec. Co.
Torrid. See Beardsley & Wolcott Mfg. Co.
Trio-Tap. See Rodale Mfg. Co.
Triple Tap. See General Elec. Co.
Twin Tap. See General Elec. Co.
United States Elec. Mfg. Co., 222 W. 14th, New York.
Un-X-Ld. See Speedway Elec'l Mfg. Co.
U. S. Electric Co., 311 Chambers, Trenton, N. J.
Utile Mfg. Co., 390 E. Liberty, Lancaster, Pa.
Weber. See Sears, Henry D.
Wellmade Elec. Mfg. Co., Torrington, Conn.
Wilshires. See Iona Co.
Yankee. See Beaver Mfg. Co.

POCKET METERS. See Instruments, Pocket.

POINTS, Contact

American Platinum Wks., 241 New Jersey Railroad Ave., Newark, N. J.
Baker & Co., Inc., 54 Austin, Newark, N. J. (Gold, Platinum, Silver.)
Coffin Mfg. Co., B. F., 30 Court, Newark, N. J. (Platinum and Silver.)
Cohn, Sigmund, 44 Gold, New York, N. Y. (Platinum.)
Elkon, Inc. (Div. of P. R. Mallory & Co.), Portchester, N. Y.
Fansteel Products Co., North Chicago, Ill.
Hardy Metal Corp., Seattle, Wash.
Hart & Hegeman Mfg. Co., Hartford, Conn.
Independent Contact Point Co., 545 39th, Union City, N. J.
Interstate Products Corp., 29 Commercial, Newark, N. J. (Platinum and Silver.)
King Mfg. Corp., Rano & Crowley Sts., Buffalo, N. Y. (Platinum.)
National Contact Co., 33 W. 60th, New York. (Platinum.)
Niehoff & Co., C. E., 230 W. Superior, Chicago. (Platinum.)
R. & H. Platinum Works, 709 Sixth Ave., New York.
Spark-O-Metal. See Hardy Metal Corp.
Wilco. See Wilson Co., H. A.
Wilson Co., H. A., 97 Chestnut, Newark, N. J. (Platinum and Silver.)

POLARITY INDICATORS. See Instruments, Pocket.
POLISHING MACHINES, WIRE. See Wire Polishing Machines.

PORCELAIN

Liquid. See Cement, Liquid Porcelain.
Molding Machine. See Presses, Porcelain Molding.
Reflectors (Enameled). See Reflectors, Porcelain Enameled.
Refractory. See Cores, Resistance Coil.

PORCELAIN, Special Shapes

Akron Porcelain Co., Akron, Ohio.
American Porcelain Co., E. Liverpool, O.
A. P. See Akron Porcelain Co.
Burgess & Co., East Liverpool, O.
Carey Ohio Porcelain Co., Carey, O.
Central Porcelain Co., Columbiana, O.
Circle F Mfg. Co., Trenton, N. J.
Colonial Insulator Co., Akron, O.
Connecticut Porcelain Co., Trenton, N. J.
Cook Pottery Co., Trenton, N. J.
Corns China Co., Wellsville, O.
Crowley & Co., Henry L., 545 N. Arlington Ave., East Orange, N. J.
Electrical Refractories Co., East Palestine, O.
Globe Porcelain Co., Mulberry St. and St. Joes Ave., Trenton, N. J.
Hartford Faience Co., Hartford, Conn.
Hub-Way Mfg. Co., Hubbard, Ohio.
Illinois Electric Porcelain Co., Macomb, Ill.
Imperial Porcelain Wks., Canal and Mulberry, Trenton, N. J.
Knox Porcelain Corp., Knoxville, Tenn.
Louthan Mfg. Co., East Liverpool, O.
Mercer Porcelain Co., Trenton, N. J.
Metsch Refractories Co., East Liverpool, Ohio.
National Porcelain Co., Trenton, N. J.
New Jersey Porcelain Co., Trenton, N. J.
Nu Blac. See Star Porcelain Co.

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Pass & Seymour, Inc., Solvay Sta., Syracuse, N. Y.
Porcelava. See Burgess & Co.
Porcelain Products, Inc., Findlay, Ohio.
Square D Company, Detroit, Mich.
Standard Porcelain Co., Leetonia, O.
Standard & Specialty Porcelain Co., Sun Prairie, Wis.
Star Porcelain Co., Muirhead St., Trenton, N. J.
Thomas & Sons Co., R., Lisbon, O.
Trenle Porcelain Co., East Liverpool, Ohio.
Union Elec'l Porcelain Wks., Inc., Trenton, N. J.
Washington Porcelain Co., Washington, N. J.

POROUS CUPS

Unglazed earthenware cups for primary (wet) batteries.
Colonial Insulator Co., Akron, Ohio.
Maddocks Sons, John, Trenton, N. J.
Ohio Pottery Co., Zanesville, Ohio.
Robinson Clay Products Co., Akron, Ohio.

POSTS, Binding

Binding Posts, Switch Parts, Stop Points, Contacts, Arms, Levers. See also Radio Mountings.
American Radio Hardware Co., 135 Grand, New York.
Bunnell & Co., J. H., 32 Park Pl., New York, N. Y.
Chapman Machine Co., Terryville, Conn.
Chase Brass & Copper Co., Waterbury, Conn.
DeJur-Amsco Corp., 418 Broome, New York, N. Y.
Eby Mfg. Co., H. H., 4710 Stenton Ave., Philadelphia, Pa.
Ensign. See Eby Mfg. Co., H. H.
Eureka. See Frank W. Morse Co.
Grammes & Sons, Inc., L. F., Allentown, Pa.
Hart & Hegeman Mfg. Co., Hartford, Conn.
Hoosick Falls Radio & Electrical Parts Mfg. Co., Hoosick Falls, N. Y.
King. See Morse Co., Frank W.
Morse Co., Frank W., 289 Congress, Boston. (Spring Grip.)
Nutmeg. See Hart & Hegeman Co.
Premier Elec. Co., Dept. 1223, 3800 Ravenswood Ave., Chicago, Ill.
Quality. See H. H. Eby Mfg. Co.
Queen. See Morse Co., Frank W.
Thomaston Mfg. Co., Thomaston, Conn.
Waterbury Button Co., Waterbury, Conn.

POTENTIOMETERS (Instruments). See Instruments, Laboratory Standard.
POTENTIOMETERS (Radio Control). See Radio Receiver Parts.
POWDERED CARBON. See Carbon, Powdered.
POWER TRANSMISSION CHAIN. See Chain, Power Transmission.
PRESS BOARD. See Cloth and Paper.

PRESSES, Armature Coil

Comstock Mfg. Co., Wilkes-Barre, Pa.

PRESSES, ARMATURE NOTCHING. See Notching Machines, Armature.

PRESSES, Molded Insulation

Burroughs Co., 246 N. Tenth, Newark, N. J.
Dunning & Boschert Press Co., 329 W. Water, Syracuse.
Elmes Engrg. Works, Chas. F., 222 N. Morgan, Chicago, Ill.
Evans Engrg. Works, Chas. E., 1002 Fulton, Chicago, Ill.
Farquhar Co., A. B., York, Pa.
Loshbough-Jordan Tool & Machine Co., Elkhart, Ind.
Southwark Fdy. & Mach. Co., 400 Washington Ave., Philadelphia, Pa.
Stokes Mach. Co., F. J., 5826 Tabor Rd., Olney, Philadelphia, Pa.
Terkelson Machine Co., 326 A, Boston, Mass.
Watson-Stillman Co., 75 West St., New York, N. Y.
Wood & Co., R. D., Florence, N. J.

PRESSES, Porcelain Molding

Baird, Andrew, 2715 Newark, Detroit, Mich.

PRESSES, Punching

Bench Presses—Power Presses; for Punching & Stamping Sheet Metal.
Ams Machine Co., Max, 101 Park Ave., New York, N. Y.
Baird Machine Co., Bridgeport, Conn.
Bliss Co., E. W., 83rd St. & Second Ave., Brooklyn, N. Y.
Dunning & Boschert Press Co., 329 W. Water, Syracuse.
Federal Press Co., Elkhart, Ind.
Ferracute Machine Co., Bridgeton, N. J.
Hyro Mfg. Co., 200 Varick, New York, N. Y.
Peck, Stow & Wilcox Co., Southington, Conn.

PRISMS, Chandelier. See Crystals, Chandelier.
PROJECTOR LENSES. See Lenses.

PULLERS, Armature Shaft

Motor Pulley, Shaft & Pinion Pullers & Extractors.
Allen Electric & Equipment Co., Kalamazoo, Mich.
Big Buster. See Premier Elec. Co.
Crane Puller Co., Waltham, Mass.
Crane Puller Co., 44 Chestnut, West Newton, Mass.
Columbia Machine Works & Malleable Iron Co., Atlantic Ave. & Chestnut St., Brooklyn, N. Y.
Duff Mfg. Company, Pittsburgh, Pa.
Electric Service Supplies Co., 17th & Cambria Sts., Philadelphia, Pa.
Little Giant. See Premier Elec. Co.
Peerless. See Electric Service Supplies Co.
Premier Electric Co., Dept. 1223, 3800 Ravenswood Ave., Chicago, Ill.
Weidenhoff, Joseph, 4352 Roosevelt Rd., Chicago, Ill.

PULLEYS, Composition

General Electric Co., Schenectady, N. Y.
Rockwood Mfg. Co., Indianapolis, Ind.
Sprucolite Co., Bloomfield, N. J.

PUMPS, Oil Burner

Janette Mfg. Co., 556 W. Monroe, Chicago, Ill.
Milwaukee Tank Wks., Milwaukee, Wis.
Monroe Machine Tool Co., 737 W. Jackson Blvd., Chicago.
Reflet. See Simplex Oil Heating Co.
Simplex Oil Heating Co., 1199 Eddy, Providence, R. I.
Teesdale Mfg. Co., 427 Market, Grand Rapids, Mich.
Zisch Engineering Co., 39 Ave. L, Newark, N. J.

PUMPS, Vacuum

To Exhaust Incandescent Lamps.
Arrow Machine Co., 527 Hackensack Plank Rd., Union City, N. J.
Beach-Russ Co., 50 Church, New York, N. Y.
Bishop & Babcock Sales Co., 4901 Hamilton Ave., N. E., Cleveland, O.
Dunham Co., C. A., 450 East Ohio, Chicago, Ill.
Elmer & Amend, 205 3rd Ave., New York, N. Y.
Elsler Engineering Co., 770 S. 13th, Newark, N. J.
General Electric Co., Schenectady, N. Y.
Hubbard's Sons, Norman, 1 Carlton Ave., Brooklyn, N. Y.

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Packard. See Hubbard's Sons, Norman.
PUNCHING PRESSES. See Presses, Punching.

PUNCHING and BENDING, Sheet Steel
Anderson Mfg. Co., Albert & J. M., 289 A, Boston, Mass.
Niagara Mach. & Tool Wks., Buffalo, N. Y.

RACKS, Wire Reel
(With Tension Device Attached).
Armature Coil Equipment Co., 2415 Forestdale Ave., Cleveland, Ohio.
Browning. See Mutual Foundry & Machine Co.
Chapman Elec'l Wks., P. E., 1820 Chouteau Ave., St. Louis, Mo. (Tensionless Dereeler)
Columbia Machine Tool Works & Malleable Iron Co., Atlantic Ave. and Chestnut St., Brooklyn, N. Y.
Comstock Mfg. Co., Wilkes-Barre, Pa.
Electric Service Supplies Co., 17th & Cambria Sts., Philadelphia, Pa.
General Elec. Co., Schenectady, N. Y. (Tension Indicator.)
Mutual Foundry & Machine Co., Atlanta, Georgia.
Segur. See Electric Service Supplies Co.

RADIO CIRCUIT COMPONENTS
This heading includes Inductances (Coils), Capacitors (Condensers), Fixed Resistances, Grid Leaks, Transformers, Choke Coils, and Filters, also Amplifier Units and Kits.
Acme Appar. Corp., 39 Osborne, Cambridge, Mass.
Acme Products Co., 22 Elkins (S. B.), Boston, Mass.
Aerovox Wireless Corp., 80 Washington, Brooklyn, N. Y.
Aero Products, Inc., 1772 Wilson Ave., Chicago, Ill.
Air-King Products Co., 222 Grand, New York, N. Y. (Kit.)
Ajax Elec. Specialty Co., St. Louis, Mo.
Alden Mfg. Co., Springfield, Mass.
All-American Mohawk Corp., 4201 Belmont Ave., Chicago.
Allen-Bradley Co., 493 Clinton, Milwaukee, Wis.
Amerchoke. See American Transformer Co.
American Specialty Mfg. Co., 165 Holland Ave., Bridgeport, Conn.
American Transformer Co., Newark, N. J
Amperite Rheostat. See Radiall Co.
Arco Elec'l Corp., 211 E. Columbia, Fort Wayne, Ind.
Arctic. See Premier Elec. Co.
Auburn Button Works, Auburn, N. Y.
Audioformer Transformer. See Pacent Electric Co.
Audiohm. See Electrad, Inc.
Autoformer. See Thordarson Elec. Mfg. Co.
Automotive Parts Mfg. Co., 70 Washington St., Brooklyn, Saleon. See Pacent Electric Co.
B-Conomizer. See Pilot Elec. Mfg. Co.
Benjamin Elec. Mfg. Co., 120 S. Sangamon, Chicago, Ill.
Birnbach Radio Co., 254 W. 31st, New York, N. Y.
Bonline. See Turn-it Radio Sales.
Branston Co., Chas. A., 297 Washington, Buffalo, N. Y.
Bremer-Tully Mfg. Co., 520 S. Canal, Chicago, Ill.
Brooklyn Metal Stamping Corp., 718 Atlantic Ave., Brooklyn, N. Y.
Browning-Drake Corp., 110 Brookline, Cambridge, Mass.
Buffer. See Aerovox Wireless Corp.
Buffalo. See De Jur-Amsco Corp.
Camfield. See Columbia Metal Products Co.
Campbell Electric Mfg. Co., 15 Stewart, Lynn, Mass.
Capacigrad. See Pilot Elec. Mfg. Co.
Cardwell Mfg. Corp., Allen D., 81 Prospect, Brooklyn, N. Y.
Carter Mfg. Co., 6300 Euclid Blvd., East Cleveland, O.
Central Radio Corp., Beloit, Wis.
Centraline. See Pilot Elec. Mfg. Co.
Certified Condenser. See Radio Condenser Co.
Chelten Elec. Co., 4859 Stenton Ave., Philadelphia, Pa.
Chicago-Jefferson Fuse & Elec. Co., 1505 W. 15th, Chicago.
Cole Radio Mfg. Corp., 536 Bloomfield Ave., Bloomfield, N. J.
Columbia Metal Products Co., 360 E. Grand Ave., Chicago,
Concertone. See Chicago-Jefferson Fuse.
Connectoralds. See Alden Mfg. Co.
Continental Carbon, Inc., Cleveland, O.
Continental. See Gardiner & Hepburn, Inc.
Counterphase Kit. See Bremer-Tully Mfg. Co.
Cresradio Corp., 166-32 Jamaica Ave., Jamaica, N. Y.
Crefot. See Premier Elec. Co.
Daven Corp., 158 Summit, Newark, N. J. (Kits)
Davohm. See Daven Corp.
DeForest Radio Co., Jersey City, N. J.
De Jur-Amsco Corp., 418 Broome, New York, N. Y.
Diamond Weave Coil. See Sickles Co., F. W.
Dongan Elec. Mfg. Co., 2985 Franklin, Detroit, Mich.
Dubilier Condenser Corp., 4377 Bronx Blvd., New York.
Duopack. See Pacent Elec. Co.
Duratran. See Dubilier Condenser Corp.
Durham & Co., 1936 Market, Philadelphia, Pa.
Dymac. See Electrical Products Mfg. Co.
Dynohmic. See Lynch, Inc.
Eagle Elec. Mfg. Co., 59 Hall, Brooklyn, N. Y.
Electrad, Inc., 173 Varick, New York, N. Y.
Electrical Products Mfg. Co., Providence, R. I. (Kit.)
Elecal Research Laboratories, 2500 Cottage Grove Ave., Chicago, Ill.
Electro Motive Engineering Corp., 127 W. 17th, New York.
Elkay. See Langbein Kaufman Radio Co.
Elkon, Inc. (Div. of P. R. Mallory & Co.), Portchester, N. Y
El Menco. See Electro Motive Engineering Co.
Equamatic Kit. See Karas Elec. Co.
Equitrol. See Cardwell Mfg. Corp.
Euphonic. See Bremer-Tully Mfg. Co.
Excelsior Radio Corp., 216 Wallabout, Brooklyn, N. Y.
E-Z. See Polymet Mfg. Corp.
Faradon. See Wireless Specialty Apparatus Co.
Fast Co., John E., Crawford & Barry Ave., Chicago, Ill.
Ferranti, Inc., 130 W. 42nd, New York, N. Y.
Filatrol. See De Jur-Amsco Corp,
Filtrola. See All-American Mohawk Corp.
Flechtheim Co., A. M., 136 Liberty, New York, N. Y.
Ford Radio & Mica Corp., 113 Bleecker, New York, N. Y.
Frost, Inc., Herbert H., 1142 W. Beardsley, Elkhart, Ind.
F. & H. Radio Laboratories, Fargo, N. D.
Gardiner & Hepburn, Inc., 611 Widener Bldg., Philadelphia, Pa.
General Instrument Corp., 477 Broadway, New York, N. Y.
General Radio Co., 30 State, Cambridge, Mass.
General Transformer Corp., 800 W. Jackson Blvd., Chicago.
General Winding Co., 214 Fulton, New York, N. Y.
Gen-Win. See General Winding Co.
Glastor. See Daven Corp.
Globar Corp., Niagara Falls, N. Y.
Glo-Dial. See Wireless Radio Corp.
Gray & Danielson Mfg. Co., 260 1st, San Francisco, Cal.
Halldorsen Co., 4745 N. Western Ave., Chicago, Ill.
Hammarlund Mfg. Co., 424 W. 33rd, New York, N. Y.
Hammarlund-Roberts, 1182 Broadway, New York. (Kit.)
Harmonic. See Karas Elec. Co.
Hart & Hegeman Mfg. Co., Hartford, Conn. (TRF Kits.)
Heath & Co., Geo. W., 260 First Ave., Newark, N. J.
Hedgehog Transformer. See Premier Elec. Co.
Heinemann Elec. Co., Philadelphia, Pa.
Hi-Q Kit. See Hammarlund.
Hy-Wat. See Electro Motive Engineering Corp.
Igrad Condenser & Mfg. Co., 26 Avenue D, Rochester, N. Y.
Infra-Dyne. See Gray & Danielson Co.
International Resistance Co., 2006 Chestnut, Philadelphia, Pa.
Isodon. See Auburn Button Works.
Isograd, Isoleak. See Pilot Elec. Mfg. Co.
Karas Elec. Co., 4040 N. Rockwell, Chicago, Ill.
Kelford. See American Specialty Co.
Kilograd. See Pilot Elec. Mfg. Co.
Krobiack. See Mountford, C. E.
Kuprox. See Kodel Radio Corp.
Langbein-Kaufman Radio Co., 62 Franklin, New Haven, Conn.
Lavite. See Aerovox Wireless Corp.
Lauts Mfg. Co., 245 N. J. R. R. Ave., Newark, N. J. (Radio Resistance).
Leakandenser. See Daven Corp.
Lekeless. See Benjamin Elec. Mfg. Co.
Lemnis. See General Winding Co.
L. M. C. See Lauts Mfg. Co.
Loftin-White. See Hammarlund Mfg. Co.
Loless. See Wireless Radio Corp.
Lynch, Arthur H., 1775 Broadway, New York, N. Y.
Marco. See Martin-Copeland Co.
Martin-Copeland Co., 101 Sabin, Providence, R. I.
Maxitran. See Electrical Research Laboratories.
Mayolian Corp., 1668 Webster Ave., New York, N. Y. (Tone Filter.)
Meggit. See Cole Mfg. Corp.
Megostat. See Pacent Elec. Co.
Melco-Supreme. See De Jur-Amsco Corp.
Melcoupler. See Robertson-Davis Co.
Meloformer. See Robertson-Davis Co.
Metalcak. See Dubilier Condenser Corp.
Metralign. See General Instrument Corp.
Micadon Condenser. See Dubilier Condenser Corp.
Micamold Radio Corp., 1087 Flushing Ave., Brooklyn, N. Y. (Amplifier Kit.)
Mica-Static. See Dubilier Condenser Corp.
Micon Condenser. See Dubilier Condenser Corp.
Microcondenser. See Sterling Mfg. Co.
Micrograd. See Pilot Elec. Mfg. Co.
Micrometric. See Karas Elec. Co.
Microstat. See Premier Elec. Co.
Midline. See Hammarlund Mfg. Co.
Modern Electric Mfg. Co., Toledo, O.
Mountford, C. E., 30 Sullivan, New York, N. Y.
Muter Co., Leslie F., 76th St. and Greenwood Ave., Chicago, Ill. (Amplifier Kits.)
National Co., 61 Sherman St., Malden, Mass.
Neutro-Grad. See Pilot Elec. Mfg. Co.
New York Coil Co., Mount Clare, Pa.
Nutmeg. See Hart & Hegeman Mfg. Co.
Ohio Carbon Co., 8215 Almira Ave., Cleveland, O.
Ohmite Mfg. Co., 642 N. Albany Ave., Chicago, Ill. (Resistance.)
Orthometric. See Karas Elec. Co.
Orthophone. See De Jur-Amsco Corp.
Pacent Electric Co., 91 7th Ave., New York, N. Y.
Pam. See Samson Elec. Co.
Panatrol. See Wireless Radio Corp.
Paragon Elec. Corp., 200 Varick, New York, N. Y.
Perry Wire Works, 280 New Main St., Yonkers, N. Y.
Phasatrol. See Electrad, Inc.
Philmore Mfg. Co., 106 7th Ave., New York, N. Y.
Piander. See De Jur-Amsco Corp.
Pierce Airo. See United Scientific Laboratories.
Pilot Elec. Mfg. Co. 323 Berry, Brooklyn, N. Y.
Pilotran. See Pilot Elec. Mfg. Co.
Potter Mfg. Co., North Chicago, Ill.
Polymet Mfg. Corp., 599 Broadway, New York, N. Y.
Power Box. See Scott Sales Co.
Powerohm. See International Resistance Co.
Powrad, Inc., 486 Johnson Ave., Brooklyn, N. Y.
Precise Mfg. Corp., 254 Mill, Rochester, N. Y.
Premier Elec Co., Dept. 1323, 3800 Ravenswood Ave., Chicago, Ill.
Protectoraid. See Alden Mfg. Co.
Pyrohm. See Aerovox Wireless Corp.
Radiall Co., 50 Franklin, New York, N. Y.
Radio Appliance Corp., Springfield, Mass.
Radio Condenser Co., Thorn & Copewood, Camden, N. J.
Radio Engrg. Laboratories, 100 Wilbur Ave., Long Island City, N. Y. (Short Wave Kit.)
Radio Flo. See Pacent Elec. Co.
Radioloc Switch. See Cutler-Hammer Mfg. Co.
Radio Receptor Co., 106 7th Ave., New York.
Radiostat. See Allen-Bradley Co.
Raola. See Modern Elec. Mfg. Co.
Rauland-Lyric. See All American Mohawk Corp.
Receptrad. See Radio Receptor Co.
Recto Mfg. Co., 23 W. Third, Cincinnati, O.
Reesonator. See F. & H. Radio Laboratories.
Regal. See American Specialty Mfg. Co.
Reliable Parts Mfg. Co., Wellington, O.
Remler. See Gray & Danielson Co.
Resistaformer. See Aerovox Wireless Corp.
Resistograd. See Pilot Elec. Mfg. Co.
Rittenhouse Co., A. E., Honeoye Falls, N. Y. (Sole Selling Agent), Hatheway & Co., 16 Hudson, New York, N. Y.
Roberts Condenser. See Hammarlund Mfg. Co.
Robertson-Davis Co., 415 Orleans, Chicago, Ill.
Samson Elec. Co., Canton, Mass. (TRF Kits.)
Sangamo Elec. Companies, Springfield, Ill.
Scanlan Elec. Mfg. Co., 1113 N. Franklin, Chicago, Ill. (Output Transformers.)
Scovill Mfg. Co., Waterbury, Conn.
Senior. See All American Mohawk Corp.
Sensory. See Heinemann Electric Co.
Sevison Magneto Engr. Co., 397 Phillips, Toledo, O.
Sickles Co., F. W., 130 Union, Springfield, Mass.
Signal Elec. Mfg. Co., Menominee, Mich.
Silver-Marshall, Inc., 846 W. Jackson Blvd., Chicago. (Amplifier Kits.)
Silvertone. See Radio Receptor Co.
S. L. S. See Wireless Radio Corp.
S. L. T. See General Instrument Corp.
Somersolo. See DeForest Radio Co.
Sonatron Tube Co., Chicago, Ill. (Resistance Coupled Amplifier).
Splitmeter. See Premier Electric Co.
Sprague Specialties Co., Dept. M., Quincy, Mass.
Standard Transformer Co., Warren, O.
Sta-Put. See Martin-Copeland Co.
Sterling Mfg. Co., 2831 Prospect Ave., Cleveland, O.
Stromberg-Carlson Tel. Mfg. Co., 1060 University Ave., Rochester, N. Y.
Super Multiformer. See Precise Mfg. Corp.
Supertran Transformer. See Ford Radio & Mica Co.
Symphony. See Modern Elec. Mfg. Co.
Syncrodenser. See Precise Mfg. Corp.
Tandem. See Bremer-Tully Mfg. Co.
Telemonic Coil. See Condenser Corp. of America.
Telos Coil. See Condenser Corp. of America.
Thompson-Levering Co., 351 N. 57th, Philadelphia, Pa.
Thordarson Elec. Mfg. Co., 500 W. Huron, Chicago, Ill.
Thorola. See Reichman Co.
Tobe Deutschman Co., Canton, Mass.
Tone Control. See Sprague Specialties Co.
Toroid. See All American Mohawk Corp.
Torostyle. See Bremer-Tully Mfg. Co.
Transcript-Clapp Kit. See Samson Electric Co.
Truphonic Amplification. See Alden Mfg. Co.
Tune Rite. See Radiall Co.
Twin-aud. See Peerless Radio Co.
Twin-Eight Transformers. See Bodine Electric Co.
Two-Ten & Two-Eleven. See Silver-Marshall.
Tyrman Elec. Corp. 143 W. Austin Ave., Chicago, Ill.
Ultimax. See Pacent Elec. Co.
Ultra Vario. See Bruno Radio Corp.
Univernier Condenser. See Auburn Button Works.
Universal Electro Chemical Corp., 30 W. 15th, New York,
Universal Winding Co., Boston, Mass.
Variall Condenser. See Muter Co.
Verni-Juster. See Brooklyn Metal Stamping Corp.
Volta. See Universal Electro Chemical Corp.
Waterbury Button Co., Waterbury, Conn.
Wireless Radio Corp., Varick Ave. & Harrison Pl., Brooklyn, N. Y.
Wireless Specialty Apparatus Co. (J. P.), Boston, Mass.
RADIO HARDWARE. See Radio Mountings.

RADIO MOUNTINGS
Coil Mountings, Coil Sliders and Rods, Switches, Detectors, Detector and Grid Leak Mountings, Panel Brackets, Special Radio Hardware & Trimmings, Metal Dials, Metal Panels, etc.
Aerovox Wireless Corp., 80 Washington, Brooklyn, N. Y.
Alden Mfg. Co., Brockton, Mass.
American Radio Hardware Co., 135 Grand, New York.
Bonza. See Haydon & Haydon.
Carborundum Co., Niagara Falls, N. Y. (Detector.)
Chase Machine Co., Terryville, Conn.
De Jur-Amsco Corp., 418 Broome, New York, N. Y.
Durham & Co., 1936 Market, Philadelphia, Pa.
Electrad, Inc., 173 Varick, New York, N. Y.
Etched Products Corp., 90 Tenth, Long Island City, N. Y. (Metal Panels.)
Eureka. See Morse Co., Frank W.
General Etching & Mfg. Co., 3072 West Grand Ave., Chicago, Ill. (Metal Panels & Escutcheons.)
Glodial. See Wireless Radio Corp.
Hart & Hegeman Mfg. Co., Hartford, Conn.
Haydon & Haydon, 167 Chambers, New York, N. Y.
Morse Co., Frank W., 291 Congress, Boston, Mass.
Muter Co., Leslie F., 76th and Greenwood Ave., Chicago.
Na-Ald. See Alden Mfg. Co.
Paragon Elec. Corp., 200 Varick, New York, N. Y.
Union Insulating Co., 296 Broadway, New York, N. Y.
Wireless Radio Corp., Varick Ave. & Harrison Pl., Brooklyn.
Yaxley Mfg. Co., 9 S. Clinton, Chicago, Ill.
RADIO PANEL ENGRAVING. See Engraving, Radio Panel.

RADIO RECEIVER PARTS
Rheostats, Sockets, Plugs, Jacks.
Acast. See United Radio Corp.
Acme Elec. & Mfg. Co., 1652 Rockwell, Cleveland, Ohio.
Alden Mfg. Co., Springfield, Mass.
Allen-Bradley Co., 493 Clinton, Milwaukee, Wis.
American Specialty Mfg. Co., 165 Holland Ave., Bridgeport, Conn.
Automotive Equipment Co., 317 Halsey, Newark, N. J.
B. M. S. See Brooklyn Metal Stamping Corp.
Beaver Mfg. Co., 625 N. Third, Newark, N. J. (Multiple Plugs.)
Benjamin Elec. Mfg. Co., 120 S. Sangamon, Chicago, Ill.
Brach Mfg. Corp., L. S., 120 Sussex Ave., Newark, N. J.
Brooklyn Metal Stamping Corp., 718 Atlantic Ave., Brooklyn.
Cabelus. See Jones, Howard B.
Carter Radio Co., 700 S. Racine Ave., Chicago, Ill. (Also Socket Adapters.)
Central Radio Laboratories, 14 Keefe Ave., Milwaukee.
Centralab. See Central Radio Laboratories.
Clarostat Mfg. Co., 285 N. Sixth, Brooklyn, N. Y.
Cle-Ra-Tone. See Benjamin Elec. Mfg. Co.
D. A. Radio Co., 30 Hollister, Buffalo, N. Y.
De Jur-Amsco Corp., 418 Broome, New York, N. Y.
De Veau. See Stanley & Patterson.
Dongan Elec. Mfg. Co., 2985 Franklin, Detroit, Mich.
Duostat. See De Jur-Amsco Corp.
E-Z. See Polymet Mfg. Corp.
Eby Mfg. Co., H. H., 4710 Stenton Ave., Philadelphia, Pa.
Electrad, Inc., 173 Varick, New York, N. Y.
Electrical Products Mfg. Co., Providence, R. I.
Fantail Plug. See Brooklyn Metal Stamping Corp.
Frost, Herbert H., 1142 W. Beardsley, Elkhart, Ind.
Gem-Jac. See Frost, Herbert H.
General Instrument Corp., 477 Broadway, New York, N. Y.
General Radio Co., 30 State, Cambridge, Mass.
Gray & Danielson Mfg. Co., 260 First, San Francisco, Cal.
Hart & Hegeman Mfg. Co., Hartford, Conn.
Heinemann Elec. Co., Philadelphia, Pa.
Imp. See Carter Radio Co.
Jones, Howard B., 2226 Wabansia, Chicago, (Multiple Plug.)
Kloner Radio Corp., 1023 E. 178th, New York, N. Y.
Martin-Copeland Co., 101 Sabin, Providence, R. I.
Modu-Plug. See Central Radio Lab.
Morse Co., Frank W., 291 Congress, Boston, Mass.
Muter Co., Leslie F., 76th & Greenwood Ave., Chicago.
National Elec. Controller Co., 5315 Ravenswood Ave., Chicago.
Pacent Elec. Co., 91 Seventh Ave., New York, N. Y.
Pan-Tab Jack. See Frost, Herbert H.
Philmore Mfg. Co., 106 Seventh Ave., New York, N. Y.
Pilot Elec. Mfg. Co., 323 Berry, Brooklyn, N. Y.
Polymet Mfg. Corp., 599 Broadway, New York, N. Y.
Premier Elec. Co., Dept. 1323, 3800 Ravenswood Ave., Chicago, Ill.
Radiall Co., 50 Franklin, New York, N. Y.
Recto Mfg. Co., 23 W. Third, Cincinnati, Ohio.
Royalty. See Electrad, Inc.
Socostat. See D. A. Radio Co.
Stanley & Patterson, 150 Varick, New York, N. Y.
Sterling Mfg. Co., 2831 Prospect Ave., Cleveland, Ohio.
Tubestat. See Muter Co.
Union Radio Corp., 124 Sussex Ave., Newark, N. J.
United Radio Corp., 25 Leighton Ave., Rochester, N. Y.
Weston Elecl. Instrument Corp., 582 Frelinghuysen Ave., Newark, N. J.
Wireless Radio Corp., Varick Ave. & Harrison Pl., Brooklyn.
Yaxley Mfg. Co., 9 S. Clinton, Chicago, Ill.

RADIO RECTIFIER TUBES
Armstrong Elec. & Mfg. Co., 351 Halsey, Newark, N. J.
Cable Supply Co., 31 Union Square, New York, N. Y.
Ceco Mfg. Co., 702 Eddy, Providence, R. I.
Conneway Elec. Laboratories, 406 Jefferson, Hoboken, N. J.
Cunningham, Inc., E. T., 370 Seventh Ave., New York, N. Y.
Daven Corp., 158 Summit Ave., Newark, N. J.
DeForest Radio Co., Franklin St. & Central Ave., Jersey City, N. J.
Diamond Vacuum Products Co., 4053 Diversey Ave., Chicago
Gold Seal Electrical Co., 250 Park Ave., New York, N. Y.
Manhattan Elecl. Supply Co., 17 Park Pl., New York, N. Y.
Northern Mfg. Co., 367 Ogden, Newark, N. J.
Perryman Electric Co., 33 W. 60th, New York, N. Y.
Radio Corp. of America, 233 Broadway, New York.
Raytheon Mfg. Co., Kendall Square Bldg., Cambridge, Mass.
Sonatron Tube Co., 108 W. Lake, Chicago, Ill.
Specialty Appliance Co., 6611 Euclid Ave., Cleveland, Ohio.
Sylvania Products Co., Emporium, Pa.
Televocal Corp., 583 Twelfth, West New York, N. J.
United Radio & Elec. Corp., 500 Chancellor Ave., Irvington, N. J.
Van Horne Tube Co., 230 Center, Franklin, Ohio.
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Alpbus. See Alpha Radio Supply Co.
Alpha Radio Supply Co., 520 Broadway, New York, N. Y.
Alpstrand. See Alpha Radio Supply Co.
American Braiding Co., Holyoke, Mass.
Arcturus Radio Co., 255 Sherman Ave., Newark, N. J. (Adapters.)
Belden Mfg. Co., 2210B S. Western Ave., Chicago, Ill.
Birnbach Radio Co., 254 W. 31st St., New York, N. Y.
Blue Ribbon. See Crescent Braid Co.
Brach Mfg. Co., L. S., Newark, N. J.
Carter Radio Co., 300 S. Racine Ave., Chicago, Ill. (Adapters.)
Connectoralds. See Alden Mfg. Co.
Cornish Wire Co., 30 Church, New York, N. Y.
Corwico. See Cornish Wire Co.
Crescent Braid Co., Providence, R. I.
Crescent Insulated Wire & Cable Co., Trenton, N. J.
De Luxe, 50 W. Houston, New York, N. Y.
Eby Mfg. Co., H. H., 4710 Stenton Ave., Philadelphia, Pa (Adapters).
Echo. See Cornish Wire Co.
Enterprise Mfg. Co., Third & Dauphin Sts., Philadelphia, Pa. (Adapters).
Frost, Inc., Herbert H., 1142 W. Beardsley, Elkhart, Ind. (Adapters.)
Lusterized. See American Braiding Co.
Manhattan Insulated Wire Co., 17 W. 60th St., New York.
Morse Co., Frank W., Boston, Mass.
Power, Inc., Harold J., Medford Hillside, Mass. (Adapters).
Radio Receptor Co., 106 Seventh Ave., New York, N. Y. (Adapters.)
Rigs. See Birnbach Radio Co.
R. U. F. Products Co., 319 Glenmore Ave., Brooklyn, N. Y.
Sterling Mfg. Co., 2831 Prospect Ave., Cleveland, Ohio. (Adapters).
Wilkens Mfg. Co., 52 Orawaupum St., White Plains, N. Y.

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Undark. See United States Radium Corp.
United States Radium Corp., 535 Pearl, New York, N. Y.

RANGE SWITCHES, Rotary Snap. See Switches, Snap, Heavy Duty.
RAWHIDE GEARS. See Gears & Pinions, Rawhide.
READING LAMP BASES. See Bases, Reading Lamp.
REAMERS, Pipe. See Stocks, Dies and Reamers.
RECEPTACLES, Lamp. See Sockets and Receptacles.

RECEPTACLES, Plug, Heavy Duty

KEY

Battery Charging ..... See B
Floor Boxes ..... See F
Welding ..... See W
Machine Tool ..... See W
Watertight, Marine, Mine ..... See M
Car Trailer Connection ..... See C
Extension ..... See E

A. B. C. See Anderson Mfg. Co.
Adam Electric Co., Frank, St. Louis, Mo. F
Adapti Co., 2996 E. 72nd, Cleveland, O.. F
Anderson Mfg. Co., Albert & J. M., 289 A, Boston, Mass. B W M C E
Appleton Elec. Co., 1703 Wellington Ave., Chicago, Ill. M
Arktite. See Crouse-Hinds Co.
Arnessen Electric Co., 13 Water, New York M
Arrow Elec. Co., Hartford, Conn.... F B W
Auth Electrical Specialty Co., 422 E. 53rd, New York, N. Y. E
Benjamin Elec. Mfg. Co., 120 S. Sangamon, Chicago, Ill. F W M
Bryant Elec. Co., Bridgeport, Conn. (Also Range Type.) W
Campbell. See Steel City Elec. Co.
Cannon Elec. Development Co., 420 West Ave., 33, Los Angeles, Cal. F
C. E. M. Co. See Conn. Elec. Mfg. Co.
C. H. See Cutler-Hammer Mfg. Co.
Circle F Mfg. Co., Trenton, N. J. M
Conduletto. See Crouse-Hinds Co.
Connecticut Elec. Mfg. Co., Bridgeport, Conn. F
Cory & Son, Chas., 133 Varick, New York M
Crouse-Hinds Co., Syracuse, N. Y.... B W
Cutler-Hammer Mfg. Co., 1388 St. Paul Ave., Milwaukee, Wis. F
Delta-Star Elec. Co., 2433 Fulton, Chicago W M
Electric Products Co., 1725 Clarkstone Rd., Cleveland, O. B
Electric Service Supplies Co., 17th & Cambria Sts., Philadelphia, Pa. C
Elwell Parker Elec. Co., 4223 St. Clair Ave., N. E., Cleveland, O. B
Fielding. See Stanley & Patterson.
Fountain's. See Jenkins Mfg. Co.
Fullman Mfg. Co., Latrobe, Pa. F
Fullman. See Steel City Elec. Co.
Gleason & Co., J. L., 241 Franklin, Boston, Mass. E
General Elec. Co., Bridgeport, Conn.... B
H. & H. See Hart & Hegeman Mfg. Co.
Hart & Hegeman Mfg. Co., Hartford, Conn. B W
Hessel Co., W. F., 76 Greenwich, New York, N. Y. W M E
Hubbell, Inc., Harvey, Bridgeport, Conn. (Also Range Type.) B W
Indestructible. See Kliegl Bros. Universal.
Jenkins Mfg. Co., Bloomfield, N. J. E
Kliegl Bros. Universal Elec. Stage Lighting Co., 321 W. 50th, New York, N. Y. F B W M
Latrobe. See Fullman Mfg. Co.
Loeffelholz & Co., Milwaukee, Wis.... C
Major Equipment Co., 4003 Fullerton Ave., Chicago, Ill. M
NePage McKenny Co., Armour Bldg., Seattle, Wash. F
Novelty Elec. Co., Tenth & Cherry Sts., Philadelphia, Pa. C
Ohio Elec. & Controller Co., 5905 Maurice Ave., Cleveland, Ohio. W
Ostrander Elect. Works, W. R., 911 Atlantic Ave., Brooklyn, N. Y.
Prest. See Walker Bros. Co.
Pyle National Co., 1334 N. Kostner Ave., Chicago, Ill. W M C E
Quadrangle Mfg. Co., 30 S. Peoria, Chicago, Ill. (Combination wall bracket and convenience outlet.)
Raleo Mfg. Co., 123 N. Albany Ave., Chicago, Ill.
Russell & Stoll Co., 53 Rose, New York F B W M E
Square D. Co., Detroit, Mich. W
Stanley & Patterson, 130 Varick, New York, N. Y. F

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Walker Bros., 1417 Sansom, Philadelphia F E
Westinghouse Elec. & Mfg. Co., East Pittsburgh, Pa. F B W M
Yale. See Electric Products Co.

RECORDERS, Elapsed Time. See Indicators, Operation.
REDUCERS, Socket. See Socket Reducers.
REFLECTOR LENSES. See Lenses.

REFLECTORS, Porcelain Enameled, Steel

4Bolite Reflector Co., 7500 Sherman Ave., Cleveland, O.
Benjamin Elec. Mfg. Co., 120 S. Sangamon, Chicago, Ill.
Cello, Inc., 96 Prince, New York, N. Y.
Dunlap Co., John, Carnegie, Pa.
Durex. See Wheeler Reflector Co.
Federal Electric Co., 8700 S. State, Chicago, Ill.
Goodlites. See Goodrich Elec. Co.
Goodrich Elec. Co., 1650 Ogden Ave., Chicago, Ill.
Isolux. See Wheeler Reflector Co.
Ivanhoe Division of Miller Co., Cleveland.
Marbelite Products Co., 140 N. Robey, Chicago, Ill.
Maxolite. See Raleo Mfg. Co.
Monk, H. E., 18 Warren, New York, N. Y.
Multi Elecl. Mfg. Co., 210 N. Ogden Ave., Chicago, Ill.
Overbaugh & Ayers, 411 S. Clinton, Chicago, Ill.
Para Steel. See Wheeler Reflector Co.
Perfection. See Tindall & White.
Philadelphia Elec'l & Mfg. Co., 1228 N. 31st, Philadelphia.
Quad. See Quadrangle Mfg. Co.
Quadrangle Mfg. Co., 30 S. Peoria, Chicago Ill.
Raleo Mfg. Co., 123 N. Albany Ave., Chicago, Ill.
Richardson Reflector Co., 16 Hudson, New York, N. Y.
Sturdox. See Benjamin Elec. Mfg. Co.
Tindall & White, 33 W. 60th, New York, N. Y.
Vaporlux. See Wheeler Reflector Co.
Westinghouse Elec. & Mfg. Co., South Bend, Ind.
Wheeler Reflector Co., 275 Congress, Boston, Mass.

REFRIGERANTS. See Chemicals, Refrigeration.
REFRIGERATION CHEMICALS. See Chemicals, Refrigeration.

REFRIGERATOR CABINETS

Airtite. See Rhinelander Refrigerator Co.
Alaska Refrigerator Co., Muskegon, Mich.
Allen Filter Co., 25 S. St. Clair, Toledo, O. (Water Cooler Unit.)
American Refrigerator Corp., Peru, Ind.
Argus Products Co., 174 E. Water, Portland, Ore.
Arlington Refrigerator Co., Arlington, Vt.
Athermos. See Gurney Refrigerator Co.
Automatic. See Illinois Refrigerator Co.
Baldwin Refrigerator Co., Burlington, Vt.
Banta Refrigerator Co., Clearfield, Pa.
Belding-Hall ElectrICE Corp., Belding, Mich.
Benjamin Electric Mfg. Co., 120 S. Sangamon, Chicago, Ill.
Bohn Refrigerator Co., St. Paul, Minn.
Boyer Refrigerator Co., 2217 Locust, St. Louis, Mo.
Camco Refrigerator Corp., 973 N. Main, Los Angeles, Cal.
Castle Double-Servis. See Home Products Corp.
Cavalier. See Tennessee Furniture Co.
Challenge Refrigerator Co., Grand Haven, Mich.
Champion Refrigerator Co., 131 E. 34th, New York, N. Y.
Cold Storage Refrigerator Co., Eau Claire, Wis.
Crystal Refrigerator Co., Fremont, Neb.
Crysteel. See Benjamin Elec. Mfg. Co.
Dillingham Mfg. Co., Sheboygan, Wis.
Dry-Cold. See Hill & Co.
Economic. See Leonard Refrigerator Co.
Eddy & Sons Co., D., 336 Adams, Boston, Mass.
Erie Art Metal Co. & Erie Metal Furniture Co., Erie, Pa.
General Necessities Corp., General Necessities Bldg., Detroit, Mich.
Gibson Refrigerator Co., Greenville, Mich.
Glookler Co., Bernard, 1627 Penn Ave., Pittsburgh, Pa.
Gruendler Mfg. Co., Gustav J., 814 N. Broadway, St. Louis.
Gurney Refrigerator Co., Fond du Lac, Wis.
Harder Refrigerator Corp., Cobleskill, N. Y.
Haskelite Mfg. Co., 120 S. La Salle, Chicago, Ill. (Knockdown.)
Heintz Mfg. Co., Front & Olney Aves., Philadelphia, Pa.
Heinz & Munschauer, Superior and Randall, Buffalo, N. Y.
Herrick Refrigerator Co., 1805 River, Waterloo, Iowa.
Hibbard Co., Euclid Ave. at 65th, Cleveland, O.
Hill & Co., C. Y., 860 Pennington Ave., Trenton, N. J.
Holderle Bros., Inc., 339 Exchange, Rochester, N. Y.
Home Products Corp., Jackson, Mich.
Howe Scale Co., Rutland, Vt.
Iceless Cooler Corp., 225 N. Michigan Ave., Chicago, Ill. (Ice Cream Cabinets.)
Illinois Refrigerator Co., Morrison, Ill.
Jewett Refrigerator Co., Buffalo, N. Y.
Kingston. See Lorillard Refrigerator Co.
Kleen Kold. See Harder Refrigerator Corp.
Knox Products Co., Fourth & Greenhill Ave., Wilmington, Del.
Knox. See Erie Art Metal Co.
Leonard Refrigerator Co., Div. of Electric Refrigeration Corp., Grand Rapids, Mich.
Ligonier Refrigerator Co., Ligonier, Ind.
Liver & Co., C. B., Omaha, Neb.
Loeber Co., Henry G., 151 E. 126th, New York, N. Y. (Ice Cream Cabinet.)
Lorillard Refrigerator Co., 44 Cooper Square, New York.
Louisville Refrigerator Co., 4460 Louisville Ave., Louisville, Ky.
Louisville Tin & Stove Co., Louisville, Ky.
Mace & Co., L. H., 55 E. 150th, New York, N. Y.
Maine Mfg. Co., Nashua, N. H.
McCray Refrigerator Sales Corp., 2364 Lake St., Kendallville, Ind.
Mowatt Refrigerator Co., 25 Oak Grove, San Francisco, Cal.

Northey Mfg. Co., Waterloo, Iowa.
Omaha Fixture & Supply Co., 11th and Douglas, Omaha.
Oreole. See Ottenheimer Bros.
Ottenheimer Bros., Baltimore, Md.
Ranney Refrigerator Co., Greenville, Mich.
Reel. See Ottenheimer Bros.
Reolite. See Ottenheimer Bros.
Revolvo. See Iceless Cooler Corp.
Rex Mfg. Co., Connersville, Ind.
Rexdale. See Rex Mfg. Co.
Rhinelander Refrigerator Co., Rhinelander, Wis.
Saco-Lowell Shops, Newton Upper Falls, Mass.
Sanitary Refrigerator Co., Fond du Lac, Wis.
Schmidt Co., C., John and Livingston, Cincinnati, O.
Seeger Refrigerator Co., St. Paul, Minn.
Sherer-Gillett Co., 601 W. Washington, Chicago, Ill.
Steeprest. See Heintz Mfg. Co.
Success Mfg. Co., Gloucester, Mass.
Tennessee Furniture Co., Chattanooga, Tenn.
Vogt. See General Necessities Corp.
Ward Refrigerator Co., 6901 S. Alameda, Los Angeles, Cal.
White Mountain. See Maine Mfg. Co.
White Seal. See Louisville Refrigerator Co.

REFRIGERATOR CONDENSER UNITS. See Condenser Units, Refrigerator.

REFRIGERATOR FITTINGS

Commonwealth Brass Corp., 5731 Commonwealth Ave., Detroit, Mich.

RELAYS

(See also Circuit Breakers and Thermostats.)
Burke Controller Co., 369 Lexington Ave., New York, N. Y.
Dunco. See Struthers Dunn, Inc.
General Electric Co., Schenectady, N. Y.
Roller-Smith Co., 239 Broadway, New York, N. Y.
Signal Engineering & Mfg. Co., 144 W. 14th, New York
Struthers Dunn, Inc., 1135 Race, Philadelphia, Pa.
Wilcolator Co., 17 Novada, Newark, N. J.

REMOTE CONTROL SWITCHES. See Switches, Remote Control.

REMOVERS, Coil

Ewing Mfg. Company, Middleport, Ohio.

RESISTANCE

Boxes. See Instruments, Laboratory Standard
Coil Cores. See Cores, Resistance.
Test Sets. See Instruments.
Units, Radio. See Radio Circuit Components.
Units. See Units, Rods & Grids.
Wire. See Wire Bare.

RESISTORS

Ohmite Mfg. Co., 642 N. Albany Ave., Chicago, Ill.
Ward-Leonard Electric Co., Mount Vernon, N. Y.

RESISTORS. See Units, Rods & Grids.
REVOLUTION COUNTERS. See Tachometers.

RHEOSTATS,
Motor-Controlling. See Controllers, also Rheostats.
Radio. See Radio Receiver Parts.
Sewing Machine. See Controllers.

RHEOSTATS

KEY

Battery Charging ..... See B
Stage Dimming ..... See D
Meter Testing (Laboratory) ..... See L
Plating Tank ..... See P
Motion Pictures (Projector Lamp) ..... See M
Motor Starting, Field and Speed Regulating. See F

F B D P M L

Allen-Bradley Co., 493 Clinton, Milwaukee L
Biddle, James G., 1211 Arch, Philadelphia L
Boice, W. B. & J. E., 1730 Norwood Ave., Toledo, O. L
Brach Mfg. Corp., L. S., Newark, N. J. (Radio Battery Control.) B
Bradleystat. See Allen-Bradley Co.
Controlite. See Ward Leonard Elec. Co.
Crown Rheostat & Supply Co., 1910 Park Ave., West Chicago, Ill. P
Cutler-Hammer Mfg. Co., 1288 St. Paul Ave., Milwaukee, Wis. F B D L
Economic Rheostat Switch Co., 3551 N. 5th, Philadelphia, Pa. F
Electric Controller & Mfg. Co., 2700 E. 79th, Cleveland, O. F
Electric Products Co., 1725 Clarkstone Rd., Cleveland, O. B
General Electric Co., Schenectady, N. Y. F L
Hanson-Van Winkle-Munning Co., Matawan, N. J. P
Holzmuller, C. J., 1108 Howard, San Francisco, Cal. D
Kliegl Bros. Universal Elec. Stage Lighting Co., 321 W. 50th, New York, N. Y. D M
Knoeller Elec. Co., De Pere, Wis. F
National Elec. Controller Co., 5315 Ravenswood Ave., Chicago F B D M L
Optimus. See Hanson-Van Winkle-Munning Co.
Robertson, Leo F., 536 W. 22nd, New York, N. Y. M
Schaefer Bros. Co., 1059 W. 11th, Chicago B
Simplicity. See Cutler-Hammer Mfg. Co.
Union Elec. Mfg. Co., Milwaukee, Wis.. F
Universal. See Ward Leonard Elec. Co.
Vitrohm. See Ward Leonard Elec. Co.
Ward Leonard Elec. Co., Mt. Vernon, N. Y. F D M
Watton. See Electric Products Co.
Westinghouse Elec. & Mfg. Co., East Pittsburgh, Pa. F M

RINGS Seal. See Packing.

RIVETS

Chase Brass & Copper Co., Waterbury, Conn.
Chicago Rivet & Specialty Co., 1830 S. 54th, Chicago, Ill.
Hassall, Inc., John, 402 Oakland, Brooklyn, N. Y.
Hungerford Brass & Copper Co., Div. of The Chase Brass Companies, Inc., 88 Lafayette, New York, N. Y.
Manufacturers Belt Hook Co., 1315 W. Congress, Chicago, Ill.
Merwin Mfg. Co., Bridgeport, Conn. (Solid & Tubular).
Nelson Rivet Co., Taunton, Mass.
Stimpson Co., Edwin B., 70 Franklin Ave., Brooklyn, N. Y.
Thomson Mfg. Co., Judson L., Waltham, Mass.
Tubular Rivet & Stud Co., 87 Lincoln, Boston, Mass.
Wright & Corson Mfg. Co., Bridgeport, Conn.

RODS, Resistance. See Units, Rods and Grids.
ROLLER BEARINGS. See Bearings, Ball and Roller.

ROLLS, Coil Flattening

Columbia Machine Tool Works & Malleable Iron Co., Atlantic Ave. and Chestnut St., Brooklyn, N. Y.

RUBBER BELTS. See Belts, Rubber.

RUBBER, Hard

Hard Rubber, Ebonite, Vulcanite.
Aetna Rubber Co., 815 E. 79th, Cleveland, O.
American Hard Rubber Co., 11 Mercer, New York, N. Y.
Connecticut Hard Rubber Co., West Haven, Conn.
Goodrich Rubber Co., B. F., Akron, O.
Luzerne Rubber Co., Murhead, near Dewey, Trenton, N. J.

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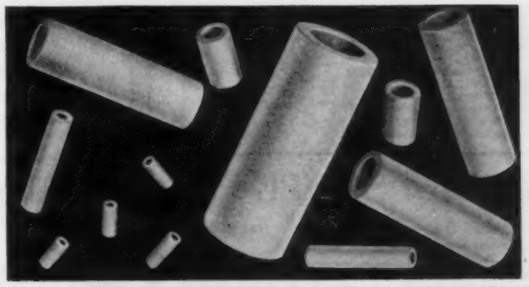

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Panelyte Co., Enterprise Ave., Trenton, N. J.
Radiolite. See Superior Hard Rubber Co.
Stokes Rubber Co., Trenton, N. J.
Superior Hard Rubber Co., Butler, N. J.
U. S. Rubber Co., 1790 Broadway, New York, N. Y.
Vulcanized Rubber Co., 251 4th Ave., New York, N. Y.
Vulco Panels. See Vulcanized Rubber Co.

RUBBER, MECHANICAL GOODS
Goodrich Rubber Co., B. F., Akron, O.
Republic Rubber Co., Youngstown, O.

RUBBER, SEMI-HARD. See Rubber Mechanical Goods.

RUBBER, Sponge
Toycraft Rubber Co., Ashland, O.

RUBBER TAPE. See Tape, Rubber and Friction.

RUBBER TUBING. See Tubing, Rubber.

RUST PROOFING. See Plating & Finishing.

SAL AMMONIAC. See Chemicals, Battery.

SALTS, Battery. See Chemicals, Battery.

SATURATING TANKS. See Wire Manufacturing Machines.

SCREW SHELLS, Socket. See Shells, Screw Socket.

SCREW MACHINE PRODUCTS
Aluminum Co. of America, 2444 Oliver Bldg., Pittsburgh, Pa.
Blake & Johnson Co., Waterbury, Conn.
Bridgeport Brass Co., 774 E. Main, Bridgeport, Conn.
Brighton Screw & Mfg. Co., 1456 Harrison Ave., Cincinnati, O.
Celoron Co., Bridgeport, Pa.
Chapman Machine Co., Terryville, Conn.
Chase Brass & Copper Co., Waterbury, Conn.
Clark Metal Products, Inc., 490 Hancock Ave., Bridgeport, Conn.
Colonial-Premier Co., 225 W. Ohio, Chicago, Ill.
Eureka Tool & Machine Co., Newark, N. J.
Faries Mfg. Co., Decatur, Ill.
Hubbell, Inc., Harvey, Bridgeport, Conn.
Indianapolis Screw Products Co., 621 N. Noble, Indianapolis,
Linden & Co., 891 Broad, Providence, R. I.
Meisel Press Mfg. Co., 944 Dorchester Ave., Boston, Mass.
Olsen Mfg. Co., 56 Commercial, Worcester, Mass.
Pheoll Mfg. Co., 5700 Roosevelt Rd., Chicago, Ill.
Plume & Atwood Mfg. Co., 474 Bank, Waterbury, Conn.
Progressive Mfg. Co., Torrington, Conn.
Scovill Mfg. Co., Waterbury, Conn.
Steiner & Co., 297 Washington, Newark, N. J.
Thomaston Mfg. Co., Thomaston, Conn.
Trumbull Elec. Mfg. Co., Plainville, Conn.
Waterbury Brass Goods Corp., Waterbury, Conn.
Wilmington Fibre Specialty Co., Wilmington, Del.

SCREWS, Cap (Cut Thread)
Bristol Co., Waterbury, Conn.
Hartford Machine Screw Co., Hartford, Conn.

SCREWS, Drive
Parker-Kalon Corp., 190 Varick, New York, N. Y.

SCREWS, Machine
Chicago Nut Mfg. Co., 2513 Cullerton, Chicago, Ill.
Clark Metal Products, Inc., 490 Hancock Ave., Bridgeport, Conn.
Hubbell, Inc., Harvey, Bridgeport, Conn.
New England Screw Co., Dept. A, 44 Farnsworth, Boston,
Progressive Mfg. Co., Torrington, Conn.
Scovill Mfg. Co., Waterbury, Conn.
Strong, Carlisle & Hammond, 1392 W. Third, Cleveland, O.

SCREWS, Machine (Cut Thread)
American Screw Co., Providence, R. I.

SECOHMMETERS. See Instruments, Laboratory Standard.

SEGMENTS. See Discs, Armature.

SEPARATORS, Storage Battery
Baltimore Battery Separator Co., Baltimore, Md.
Campbell Elec. Co., Kansas City, Mo.
Carlile & Doughty, 2530 N. Broad, Philadelphia, Pa.
Chattanooga Battery Box Co., Chattanooga, Tenn.
Certified. See Ermet Products Co.
Consumers Rubber Co., 1302 Ontario, Cleveland, O.
Ermet Products Co., Sherman Drive & 16th, Indianapolis, Ind. (Wood.)
Estes & Sons, E. B., 25 Vanderbilt Ave., New York. (Wood.)
Ferry Mfg. Co., St. Louis, Mo.
Indianapolis Box & Separator Co., 1450 E. 19th St., Indianapolis, Ind. (Wood.)
Indianapolis Mfg. Co., Indianapolis, Ind.
Inseco. See Indianapolis Box & Separator Co.
Link & Hemrick, Inc., 555 W. 52nd, New York, N. Y.
Red Band. See Indianapolis Mfg. Co.
Stewart Mfg. Co., Wm. E., 14th & Elm, Flint, Mich. (Wood.)
Wick Lumber Co., R., 539 W. 52nd, New York. (Wood.)

SHADES
Aluminum. See Shades, Metallic.
Asbestos. See Shades, Fabric.
Bamboo. See Shades, Fabric.
Brass. See Shades, Metallic.
Cast Metal. See Shades and Domes.
Copper. See Shades Metallic.
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Parchment. See Shades, Fabric.
Silk. See Shades, Fabric.
Stamped Metal. See Shades, Metallic; also Shades and Domes.
Steel. See Shades, Metallic.
Tin. See Shades, Metallic.
Zinc. See Shades, Metallic.

SHADES, Fabric
Asbestos Cretonne, Leather, Linen, Paper, Silk, Bamboo, Parchment.
Acme Lamp Shade Co., 630 W. Madison, Chicago. (Silk.)
Adelphi Lamp Shade Co., 242 Fifth Ave., New York. (Silk.)
Admiration Lamp Shade Co., 160 Madison Ave., New York, N. Y. (Silk.)
Andrews Co., C. M., 32 E. 30th, New York, N. Y. (Silk.)
Art Lamp Shade Studios, 316 Fifth Ave., New York, N. Y.
Audrey Art Shade Studios, 105 Thatford Ave., Brooklyn.
Block & Co., L. D., 37 E. 18th St., New York, N. Y.
Borghese. See Hall, Chas.
Daiger Co., Charles V., 76 Essex, Boston, Mass. (Silk.)
Eastern Art Shop, 14 W. 19th, New York. (Parchment.)
Foss Parchment Shade Studio, 1338 E. 12th, Oakland, Cal. (Parchment.)
Foslite. See Foss Parchment Shade Studio.
Frostelene. See Art Lamp Shade Studios.
Gibson Art Co., 223 W. Fourth, Cincinnati, Ohio. (Paper.)
Hall, Chas., 3 E. 40th, New York, N. Y. (Paper Parchment.)
Hanson Co., Paul, 15 E. 26th, New York, N. Y. (Chints.)
Harris Mfg. Co., 122 University Place, New York, N. Y. (Parchment.)
Herco Art Mfg. Co., Meriden, Conn.
Hoft Studio, 46 W. 21st, New York, N. Y. (Parchment.)
Idealite Elec. Lamp Shade Mfg. Co., 7 E. 17th, New York, N. Y. (Parchment.)
Kapa Shell. See Wardwell, E. H.
Kelton Mfg. Co., Worcester, Mass. (Silk.)
Kerwin. See Hall, Chas.
Kno-Glair. See Hamilton, M. E.
Lamb Bros. & Greene Corp., Napannee, Ind. (Silk.)
Luxrite. See John H. St. John.
Maxwell-Ray Co., Milwaukee, Wis. (Silk.)
Monarch Lamp & Shade Co., 210 N. Second, Philadelphia, Pa. (Silk.)
Morimura Bros., 58 W. 23rd, New York. (Bamboo, Silk, Cretonne.)
Parchment Novelty Co., 87 E. 10th, New York, N. Y. (Parchment.)
Patent Lamp Shade Co., 1361 Franklin Ave., Philadelphia.
Peerless Lamp Shade Mfg. Co., 114 E. 25th, N. Y. (Silk.)
R. D Electric Co., Fort Wayne, Ind. (Linen and Silk.)
Reuter, Wm., 32 W. 34th, New York, N. Y. (Silk.)
Rindsberger Mfg. Corp., 22 E. 24th, Chicago, Ill.
Rosita Studio, 10 W. 28th, New York, N. Y. (Parchment and Leatherette.)
Sanderson's Art Co., Milwaukee, Wis. (Parchment.)
Springel & Son, A., 26 S. 3rd, Philadelphia, Pa.
St. John, John H., 1298 Atlantic Ave., Brooklyn, N. Y. (Silk.)
Storrs Mica Co., 11 Park Place, New York, N. Y.
Straus-Hohenstein Co., 133 W. 21st, New York. (Silk.)
Superior Lamp Shade Manufacturers, 72 Madison Ave., New York, N. Y. (Silk.)
Tapestrelle Corp., 44 E. 29th, New York, N. Y.
Tombs Studios, Wm. H., 172 Pennsylvania Ave., Newark, N. J. (Parchment Paper.)
Trio Mfg. Co., 610 N. American, Philadelphia, Pa. (Silk.)
Troy Art Studio, 624 2d Ave., Troy, N. Y.
Utility Shade Co., Tenafly, N. J.
Vogue Lamp & Shade Co., 130 W. 17th, New York, N. Y. (Parchment.)
Volkman Co., 3223 W. Lake, Chicago, Ill.
Wardwell, E. H., 11 E. 36th, New York, N. Y.

SHADES AND DOMES
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Badanes Mfg. Co., 62 Greene, New York, N. Y.
Bayley & Sons, 105 Vanderveer, Brooklyn, N. Y.
Handel Co., Meriden, Conn.
Mosaic Shade Co., 589 E. Illinois, Chicago, Ill.
Mutual Sunset Lamp Co., 21 E. Houston, New York, N. Y.
Novelty Lighting Corp., 2488 E. 22nd, Cleveland, O.
Royal Art Glass Co., 2572 Park Ave., New York, N. Y.
Standard Elec. & Mfg. Co., Cedar Rapids, Ia.
Western Art Glass Shade Works, 101 Turk, San Francisco.

SHADES, FACTORY WINDOW. See Window Shades, Factory.

SHADES, Metallic
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A. A. Elec. Mfg. Co., Bridgeport, Conn. (Sole selling agent, Harry Pickhardt, 129 W. 15th, New York, N. Y.)
Durex. See Wheeler Reflector Co.
Faries Mfg. Co., Decatur, Ill. (Brass, Aluminum, Tin, Copper.)
Frink Co., Inc., 369 Lexington Ave., New York, N. Y. (Aluminum, Brass, Zinc, Iron, Steel.)
Hubbell, Inc., Harvey, Bridgeport, Conn. (Aluminum, Brass, Steel, Tin.)
Miller Co., Meriden, Conn.
Monk, H. E., 18 Warren, New York, N. Y. (Tin, Aluminum, Brass, Copper, Zinc & Steel).
Oameo. See Overbaugh & Ayres Mfg. Co.
Overbaugh & Ayres Mfg. Co., 411 S. Clinton, Chicago, Ill.
Richardson Reflector Co., 16 Hudson, New York, N. Y.
Standard Elec. Supply Co., 223 N. 13th, Philadelphia, Pa.
Western Reflector Co., 1221 W. Madison, Chicago. (Tin.)
Wheeler Reflector Co., 275 Congress, Boston, Mass.

SHADES, Mica
Hirsch Mica Co., 1087 Flushing Ave., Brooklyn, N. Y.
Huse-Liberty Mica Co., 73 Long Wharf, Boston, Mass.
Kant-Krack. See Huse Liberty Mica Co.

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Tar Heel Mica Co., Plumtree, N. C.
Tarmilite. See Tar Heel Mica Co.

SHAFT COUPLINGS. See Couplings, Shaft.

SHAFTS, Flexible. See Tubing, Flexible Metallic.

SHAPING MACHINES, Coil
Munsdorf Company, W. P., 720 Frankfort, Cleveland, Ohio

SHEARS, Insulation
Electric Service Supplies Co., 17th & Cambria Sts., Philadelphia, Pa.

SHEET STEEL CABINETS. See Cabinets, Sheet Steel.

SHELLS, Screw Socket
Chase Brass & Copper Co., Waterbury, Conn.
Patton-MacGuyer Co., Providence, R. I.
Risdon Mfg. Co., Naugatuck, Conn.
Scovill Mfg. Co., Waterbury, Conn.
Torrington Mfg. Co., 70 Franklin, Torrington, Conn.
Waterbury Brass Goods Corp., Waterbury, Conn.
Waterbury Button Co., 800 S. Main, Waterbury, Conn. (Miniature.)

SHUNTS, Instruments. See Instruments, Laboratory Standard.

SIGN FLASHERS. See Flashers, Sign.

SIGN LETTER LENSES. See Lenses.

SILICA
Ottawa Silica Co., Ottawa, Ill. "Flint Shot."

SILK, Cloth Insulated. See Cloth & Paper.
Shades. See Shades, Fabric.
Tape. See Tape.
Thread. See Yarn, etc.

SILVER, Metal and Wire
Baker & Co., Inc., 54 Austin, Newark, N. J.
Handy & Harman, 57 William, New York, N. Y.
Wilco. See Wilson Co., H. A.
Wilson Co., H. A., 97 Chestnut, Newark, N. J.

SILVER SOLDER. See Solder, Silver.

SINE WAVE OSCILLATORS. See Instruments, Laboratory Standard.

SKINNERS WIRE. See Scrapers.

SLABS, Switchboard. See Asbestos Slabs; also Molded Insulation, Slate; Soapstone.

SLATE
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Structural Slate Co., Pen Argyl, Pa.

SLEEVE-BEARINGS. See Bearings and Bushings.

SLEEVING, Cotton. See Tape, Cotton.

SLOTTING FILES. See Files, Commutator Slotting.

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Binghamton Flexible Shaft Co., Binghamton, N. Y.
Burke Controller Co., 369 Lexington Ave., New York, N. Y.
Burton & Rogers Co., 857 Boylston, Boston, Mass.
Electric Service Supplies Co., 17th & Cambria Sts., Philadelphia, Pa.
General Electric Co., Schenectady, N. Y.
Hobart Bros. Co., Troy, Ohio.
Hullhorst Micro Tool Co., 3240 E. Monroe, Toledo, O.
Imperial. See Martindale Elec. Co.
Martindale Electric Co., 1262 W. Fourth, Cleveland, Ohio.
Onan, David W., 43 Royalstone Ave., Minneapolis, Minn.
Peerless. See Electric Service Supplies Co.
Ransom & Randolph Co., Superior & Chestnut, Toledo, Ohio.
Simplex. See Weidenhoff, Joseph.
Weidenhoff, Joseph, 4252 Roosevelt Rd., Chicago, Ill.

SNAP SWITCHES. See Switches, Snap

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For Switchboard Slabs and Barriers.
Alberene Stone Co., 153 W. 23rd, New York, N. Y.
Lin-Stun. See Westinghouse.
Soapstone Products Co., 97 Warren, New York, N. Y.
Westinghouse Elec. & Mfg. Co., East Pittsburgh, Pa.

SOCKET LININGS. See Linings, Socket

SOCKET SHELLS. See Shells, Screw Socket.

SOCKETS, Flashing. See Flashers, Sign.

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American Brass Co., 25 Broadway, New York, N. Y. (Acorns.)
Arrow Electric Co., Hartford, Conn.
Benjamin Electric Mfg. Co., 120 S. Sangamon, Chicago, Ill.
Bryant Electric Co., Bridgeport, Conn.
Duplex. See Warner Bros. Co.
Eade, John E., 104 Point, Providence, R. I. Links, Insulators.
Easylite. See Rittenhouse Co., A. E.
Economy. See Harvey Hubbell, Inc.
Fiory, Wm. E., 38 W. 32nd, New York, N. Y. (Decorative Pull Chains.)

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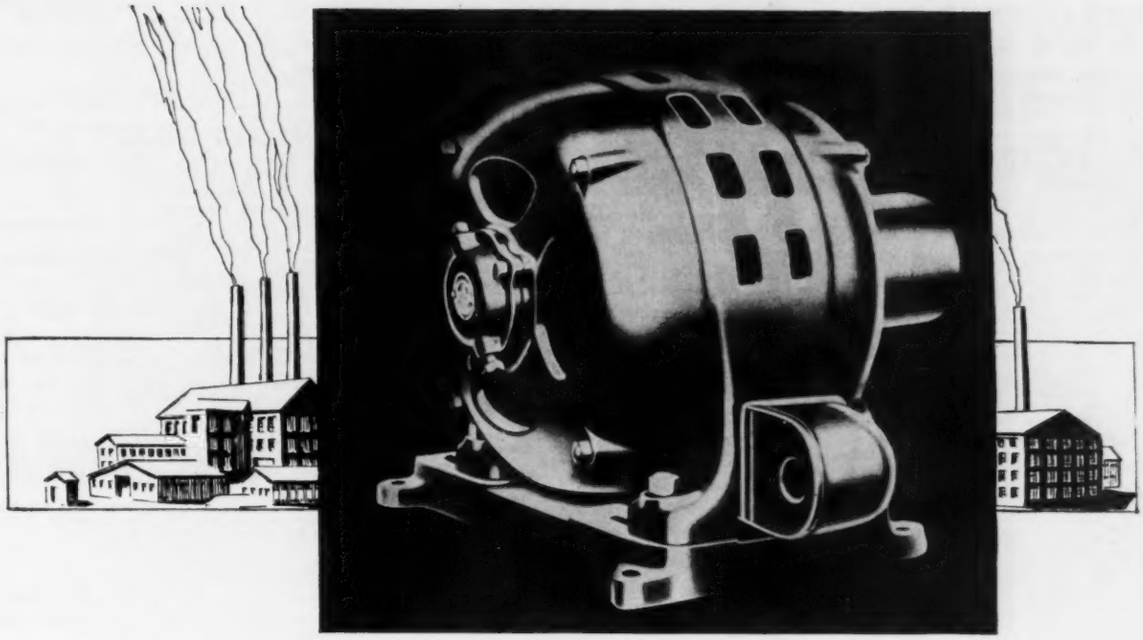

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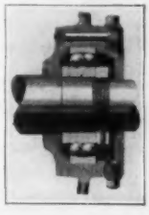
Sealed ball bearings require lubrication but once a year. This is further simplified by F-M Measured Grease Lubricant in tubes.



But *more important—Fairbanks-Morse refuses to employ any economies in design, materials or manufacture which increase the actual cost of its motors by* sacrificing dependable performance and low maintenance.

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SOCKET CHAIN AND ATTACHMENTS—Continued
Gripper. See Wittenberg Bros.
Harrigan, T. M., Woodstock, Vt. (Links.)
Hart & Hegeman Mfg. Co., Hartford, Conn. (Metal Pull Tassel.)
Hubbell, Inc., Harvey, Bridgeport, Conn. (Links and Acorns. Metal Pull Tassels.)
Paiste. See Hart & Hegeman Mfg. Co.
Pass & Seymour, Inc., Solvay Sta., Syracuse, N. Y. (Pull Chain Tassel.)
P. & S. See Pass & Seymour, Inc.
Rittenhouse Co., A. E., Honeoye Falls, N. Y. (Sole Selling Agent, Hatheway & Co., 16 Hudson, New York, N. Y.)
Rodale Mfg. Co., 200 Hudson, New York, N. Y.
Royal. See Sears, Henry D.
Scovil Mfg. Co., Waterbury, Conn. (Acorn.)
Sears, Henry D., 50 Boylston, Boston, Mass.
Weber. See Sears, Henry D.
Wittenberg Bros., 60 Shipman, Newark, N. J. Links, Insr.

SOCKET REDUCERS

Arrow Elec. Co., Hartford, Conn.
Benjamin Electric Mfg. Co., 120 S. Sangamon, Chicago, Ill.
Can-del-lite. See Sears, Henry D.
Eagle Electric Mfg. Co., 59 Hall, New York, N. Y.
Electric Co., 94 Allyn, Hartford, Conn.
General Electric Co., Merchandise Dept., Bridgeport, Conn.
Hart & Hegeman Mfg. Co., Hartford, Conn.
Morse Co., Frank W., 201 Congress, Boston, Mass.
Pass & Seymour, Solvay Sta., Syracuse, N. Y.
Propp Co., M., 524 Broadway, New York, N. Y.
Rodale Mfg. Co., 200 Hudson, New York, N. Y.
Sears, Henry D., 50 Boylston, Boston, Mass.
SOCKETS, Radio. See Radio Receiver Parts.

SOCKETS AND RECEPTACLES, Lamp

Bases other than Standard (or Medium) are indicated as follows: Mogul, M; Candelabra (or Miniature), C.

Key ..... See K
Composition ..... See W
Metal Shell ..... See B
Porcelain ..... See A
Pull Chain ..... See P
Push Through ..... See T
Sign Receptacles ..... See A

A. B. C. See Leviton Mfg. Co.
Acme Elec. & Mfg. Co., Canal & Hamilton Ave., Trenton, N. J. ..... A
Alabax. See Arrow Elec. Co.
Appleton Electric Co., 1730 Wellington Ave., Chicago, Ill. ..... A
Armstrong & White, 9th and Liberty Ave., Pittsburgh, Pa. ..... A
Arrow Elec. Co., Hartford, Conn. ..... M C K T P B A
Arrogrip. See Arrow Elec. Co.
Atlantic Elec. Lamp Co., Salem, Mass. ..... K .. P ...
A. & W. See General Outdoor Adv. Co.
Beaver Mfg. Co., 625 N. Third, Newark, N. J. ..... C .... P B .
Best. See United States Elec. Mfg. Corp.
Bryant Elec. Co., Bridgeport. ..... M C K T P B A
C-H. See Cutler-Hammer Mfg. Co.
Circle F Mfg. Co., Trenton, N. J. ..... M .. K T P B A
Circle T. See Trumbull Elec. Mfg. Co.
Colt's Patent Fire Arms Mfg. Co., Hartford, Conn. .....
Connecticut Elec. Mfg. Co., Bridgeport, Conn. ..... M .. K T .. B A
Crouse-Hinds Co., Syracuse, N. Y. ..... A W .....
Cutler-Hammer Mfg. Co., 1287 St. Paul Ave., Milwaukee, Wis. ..... K T .. B A
Durex. See Wheeler Reflector Co.
Eagle Elec. Mfg. Co., 59 Hall, Brooklyn, N. Y. .....
Economy Fuse & Mfg. Co., 3717 Greenview Ave., Chicago, Ill. ..... P B ..
Far-Go Elec. Mfg. Co., 368 Broome, New York, N. Y. ..... C .....
Federal Electric Co., 8700 S. State, Chicago, Ill. ..... A
Flute. See Pass & Seymour.
Flutelier. See Pass & Seymour.
Frink Co., Inc., 369 Lexington Ave., New York, N. Y. ..... M C ..... B ..
Gaynor Elec. Co., Bridgeport, Conn. ..... A
General Elec. Co., Bridgeport, Conn. ..... M C K T P B A
Glow Elec. Co., 22 Queens, Long Island City, N. Y. ..... M ..... B ..
Hart & Hegeman Mfg. Co., Hartford, Conn. ..... M C K T P B A
Hoosick Falls Radio & Elec'l Parts Mfg. Co., Hoosick Falls, N. Y. ..... W .....
Hubbell, Inc., Harvey, Bridgeport, Conn. M C K T P B A
H. & H. See Hart & Hegeman.
I-D-A. See Watson Mfg. Co., J. E.
K-E Cleat Receptacle. See Kirkman.
Kirkman Engineering Co., 1 Dominick, New York. (Cleat Receptacle.) .....
Leader. See Leviton Mfg. Co.
Leiser & Co., W. A., 1607 Sansom, Philadelphia, Pa. ..... A
Leviton Mfg. Co., 236 Newell, Brooklyn, N. Y. ..... M C K .. P B A
Levoller. See McGill Mfg. Co.
Liberty Bell. See Hart & Hegeman.
Locat-A-Catch. See Connecticut.
McGill Mfg. Co., Valparaiso, Ind. ..... P B A
Majestic Elec. Mfg. Co., 806 N. 12th, St. Louis. (Lamp Receptacle.) ..... A
Meteor Elec. Corp., 499 E. 76th, New York, N. Y. ..... K .. P ....
Molded Socket Corp., Railroad, Pa. ..... K .....
Multi Elec'l Mfg. Co., 210 N. Ogden Ave., Chicago, Ill. ..... A
Multilok. See Circle F Mfg. Co.
Newgard. See Multi Elec'l Mfg. Co.
New Wrinkle. See Bryant Elec.
Noark. See Colt's Patent Fire Arms.
One 4 All. See Propp Co., M.
P. & S. See Pass & Seymour.
Pass & Seymour, Solvay Station, Syracuse, N. Y. ..... M C K T P B A
Paulding, John L., New Bedford, Mass. ..... B A
Perkins. See Bryant Elec. Co.
Porcelain Products, Inc., Findlay, O. ..... A
Propp Co., M., 524 Broadway, New York, N. Y. .....
Quick Catch. See Hubbell, Inc.
Ratner Elec. Mfg. Co., 195 Morgan Ave., Brooklyn, N. Y. ..... M ..... P B ..
Roberts Elec. Mfg. Co., 211 Centre, New York, N. Y. (Candle.) ..... T .. B ..
Royal. See Sears, Henry D.
Safti Soc. See Molded Socket Corp.
Sears, Henry D., 50 Boylston, Boston M C K T P B A
Security. See Circle F Mfg. Co.
Shurlock. See Pass & Seymour.
Siemen Co., Bridgeport, Conn. .....
Taplet Mfg. Co., 3709 Powelton Ave., Philadelphia, Pa. ..... A
TEC. See Electric Company.
Titan. See Bryant Elec. Co.
Trumbull Elec. Mfg. Co., Plainville, Conn. ..... A
Union Insul. Co., Parkersburg, W. Va. .....
United States Elec. Mfg. Corp., 222 W. 14th, New York, N. Y. ..... P .. B .. W
U. S. Electric Co., 211 Chambers St., Trenton, N. J. ..... A
Walco. See Leiser & Co., W. A.
Waterbury Button Co., Waterbury, Conn. .....
Watson Mfg. Co., J. E., 5506 N. Fifth, Philadelphia, Pa. (Concealed Fixture) ..... P B ..
Weber. See Sears, Henry D.
Wheeler Reflector Co., 275 Congress St., Boston, Mass. ..... P ....
Wiring Devices, Inc., 5 High, Trenton, N. J. ..... A
Wood Electric Co., C. D., 565 Broadway, New York. (Sign Receptacles.) ..... A
Woodwin. See Wood Elec. Co.
Wrinkle. See Bryant Elec. Co.

SOLDER, Aluminum

Allen Co., Inc., L. B., 6750 Bryn Mawr Ave., Chicago, Ill.
Lenk Mfg. Co., 30 Merrimac, Boston, Mass.
Platt Bros. & Co., Waterbury, Conn.
Union Smelting & Refining Co., Newark, N. J.
Usarco. See Union Smelting & Refining Co.

SOLDER, Bar and Wire

Eagle. See Hoyt Metal Co.
Genuine A. See Hoyt Metal Co.
Hoyt Metal Co., St. Louis, Mo.

SOLDER, Self-Fluxing

American Solder & Flux Co., 2910 N. 16th, Philadelphia.
Belden Mfg. Co., 2310B S. Western Ave., Chicago, Ill.
Cambridge Smelting Co., Cambridge, Mass.
Dutch-Boy. See National Lead Co.
Gardiner Metal Co., 1366 W. Lake, Chicago, Ill.
Kester. See Chicago Solder Co.
Lenk Mfg. Co., 32 Merrimac, Boston, Mass.
National Lead Co., 111 Broadway, New York, N. Y.
Solderall Co., 129 Sussex Ave., Newark, N. J.
Tinol. See American Solder & Flux Co.

SOLDER, Silver

Handy & Harman, 57 William, New York, N. Y.
Wilson Co., H. A., 97 Chestnut, Newark, N. J.

SOLENOIDS. See Coils, Finished.

SOLDERING
Compounds. **See Soldering Compounds.**
Irons. See Soldering Irons.
Machines. See Soldering Machines, Commutator Tools. See Torches and Furnaces.

SOLDERING COMPOUNDS

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American Solder & Flux Co., 2910 N. 16th, Philadelphia, Pa. Flux, Paste, Salts.
Amco. See American Solder & Flux Co.
Belden Mfg. Co., 2310B S. Western Ave., Chicago, Ill.
Benson Co., Alex R., Hudson, N. Y. (Salts and Paste.)
Burnley Battery & Mfg. Co., North East, Pa. Paste and Stick.
Brunner Chemical Wks., 217 E. 3rd, Cincinnati, O.
Callahan & Co., Geo., 218 Front, New York. (Fluid.)
Central Stamping Co., 206 Broadway, New York, N. Y. Paste and Salts.
Challenge. See Highland Electro Chemical Co.
Conductalute. See Technical Products Co.
Crescent. See McGill Mfg. Co.
Diamond. See Burnley Battery & Mfg. Co.
Dielectric Mfg. Co., St. Louis, Mo.
Dunton Co., M. W., Providence, R. I.
Dutch-Brand. See Van Cleef Bros.
Eureka. See Grasselli Chemical Co.
Firth Radio Corp., 25 Beaver, New York, N. Y.
Fluxite. See Monarch Products Co.
General Elec. Co., Bridgeport, Conn. (Paste).
Grasselli Chemical Co., Guardian Bldg., Cleveland, O.
Highland Electro Chemical Mfg. Co., Connellsville, Pa. (Paste, Stick, Salts.)
Incomparable. See Reade Mfg. Co.
Letellier Laboratories, 119 Main St. E., Rochester, N. Y.
Leveridge, Chas. W., 246 Fulton, New York, N. Y.
Luco. See Lukens Metal Co.
Lukens Metal Co., T. F., 1105 Fairmount Ave., Philadelphia, Pa.
McGill Mfg. Co., Valparaiso, Ind. Fluid.
Mitchell-Rand Mfg. Co., 19 Vesey, New York. (Paste.)
Monarch Products Co., Red Bank, N. J.
Neer Co., L. F., Butler, O. (Flux and Solution.)
Neutral. See Dielectric Mfg. Co.
New-Idea. See Hartwig Co., Wm. J.
Nokorode. See Dunton Co., M. W.
Oakwood. See Weaver Specialty Co.
Paragon Insulating Co., 5716 Euclid Ave., Cleveland, O.
Perfecto. See Firth Radio Corp.
Pfanstiehl Chemical Co., Waukegan, Ill. Paste, Salts, Sticks, Fluid, Oil, and Solid Sal Ammonics.
Queens. See Brunner Chemical Works.
Reade Mfg. Co., 133 Hoboken Ave., Jersey City, N. J. (Fluids, Salts, Paste).
Redens. See Reade Mfg. Co.
Red-Letter. See Ruby Chemical Co.
Rodale Mfg. Co., 200 Hudson, New York, N. Y. (Paste.)
Rotax Mfg. Co., 380 E. 133rd, New York, N. Y.
Ruby Chemical Co., Columbus, O.
Ruby Fluid. See Ruby Chemical Co.
Salbrick. See American Solder & Flux Co.
Silva-Wares, Inc., 134 W. 26th, New York, N. Y.
Snarr & Co., Geo. W., 110 S. Ninth, St. Louis, Mo. (Paste.)
Snowflake. See Grasselli Chemical Co.
Snowflake. See Highland Electro Chemical Co.
Solderall Co., 129 Sussex Ave., Newark, N. J.
Solderine. See Central Stamping Co.
Solderite, Inc., 22 Green, Newark, N. J.
Speco. See Pfanstiehl Chemical Co.
Standard. See Grasselli Chemical Co.
Star. See McGill Mfg. Co.
Superior. See Highland Electro Chemical Co.
Technical Products Co., 114 S. Sheridan Sq., Pittsburgh, Pa. (Paste).
Tinol. See American Solder & Flux Co.
Tislt. See Letellier Laboratories.
Van Cleef Bros., 7722 Woodlawn Ave., Chicago, Ill.
Weaver Specialty Co., 6344 Aurelia, Pittsburgh, Pa.
Yager's. See Benson Co., Alex R.
Yankee. See Leveridge, Chas. W.

SOLDERING IRONS

Acme Elec. Heating Co., Dept B, 1217 Washington, Boston.
Adroit. See Adrola Corp.
Adrola Corp., Port Jefferson, N. Y.
American Beauty. See American Elecl. Heater Co.
Americal Elecl. Heater Co., Detroit, Mich.
Beardsley & Wolcott Mfg. Co., Waterbury, Conn.
Beckwith Machine Co., Ravenna, Ohio.
Betsy Ross. See Central Flatiron Mfg. Co.
Bode. See Baco Electric Co.
Brach Mfg. Corp., L. S., Newark, N. J.
Burnley Battery & Mfg. Co., North East, Pa.
Central Flatiron Mfg. Co., Johnson City, N. Y.
Chapman Machine Co., Terryville, Conn.
Cutler-Hammer Mfg. Co., 1238 St. Paul Ave., Milwaukee.
Davis Specialty Works, East Gary, Ind.
Dominion Elec'l Mfg. Co., 712 Ontario Ave., N., Minneapolis.
Dover Mfg. Co., Dover, O.
Drake Elec. Wks., 3943 Lincoln Ave., Chicago, Ill.
Edison Elec. Appliance Co., 5600 W. Taylor, Chicago, Ill.
Electrahot Mfg. Co., 525 S. 4th, Minneapolis, Minn.
Electric Heat Control Co., 5902 Carnegie Ave., Cleveland. (Transformer Soldering Outfit.)
Electric Soldering Iron Co., 124 W. 18th, New York.
Electrical Products Mfg. Co., Providence, R. I.
Enco. See Electrical Necessities Corp.
Esico. See Electric Soldering Iron Co.
Everhot. See Swartzbaugh Mfg. Co.
Ever-Ready. See Gold Seal Elec. Co.
General Electric Co., Schenectady, N. Y.
Gold Seal Elec. Co., 250 Park Ave., New York, N. Y.
Home. See Majestic Elec. Appliance Co.
Illinois Stamping & Mfg. Co., 220 N. Jefferson, Chicago, Ill.
Industrial. See Permway Mfg. Co.
Jiffy. See Koch & Co., Paul W.
Junior. See Drake Elec. Wks.
King. See Electric Heat Control Co.
Koch Co., Paul W., 23 S. Wells, Chicago. (Solder Dipper.)
Landers, Frary & Clark, New Britain, Conn.
Lenk Mfg. Co., 30 Merrimac, Boston, Mass.
Lotan. See Simplex Flux & Solder Co. of America.
Lucifer. See Jones Point Tool & Elec. Co.
McAdams Co., J. C., Long Island City, N. Y.
Majestic Electric Appliance Co., San Francisco, Cal.
Manning-Bowman & Co., Meriden, Conn.
Mechanics. See Drake Elec. Wks.
Moto-Ray Mfg. Co., 169 Massachusetts Ave., Boston, Mass.
National Specialties Co., First National Bank Bldg., Fort Wayne, Ind.
Northern Elec. Co., 2833 N. Western Ave., Chicago, Ill.
Nu-Way. See McAdams Co.
Queen Quality. See Watlow Elec. Mfg. Co.
Quick-Hot. See Moto-Ray Mfg. Co.
Radio See Drake Elec. Wks.
Regular. See National Specialties Co.
Reliance. See Landers, Frary & Clark.
Samson Cutlery Co., 8 Jones St., Rochester, N. Y.
Security Elec. Mfg. Co., 2633 Canton, Chicago, Ill.
Silver King. See Illinois Stamping & Mfg. Co.
Simplex Flux & Solder Co. of America, 1965 E. 66th, Cleveland, O.
Soderwand. See Suttle Equipment Co.
Superior Elec. Products Co., 1300 S. 13th, St. Louis, Mo.
Suttle Equipment Co., Lawrenceville, Ill.
Swartzbaugh Mfg. Co., 1501 W. Bancroft, Toledo, O.
Torrid. See Beardsley & Wolcott Mfg. Co.
Trent, Harold E., 295 N. Lawrence, Philadelphia, Pa.
Varick Elec. Mfg. Co., 28 E. 21st St., New York, N. Y.
Vulcan Elec. Heating Co., 225 Varick, New York, N. Y.
Waage Elec. Co., 5100 W. Ravenswood Ave., Chicago, Ill.
Ward Mfg. Co., 937 Wellington Ave., Chicago, Ill.
Watlow Elec. Mfg. Co., 1320 N. 23rd, St. Louis, Mo.
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SOLVENTS & REDUCERS, VARNISH. See Paint, Varnish, Lacquer.
SPAGHETTI. See Tubing, Varnished Fabric.
SPEED CHANGING UNITS. See Gears (Speed Changing Units).
SPEED INDICATORS. See Tachometers.
SPOOLING MACHINES, WIRE. See Wire Manufacturing Machines.

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Babco. See Simonds Paint Spray Brush Co.
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De Vilbiss Mfg. Co., 3750 Detroit Ave., Toledo, Ohio.
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Eureka Pneumatic Spray Co., 87 130th, Richmond Hill, N.Y.
Ideal Air Brush Mfg. Co., 203 Lafayette, New York, N. Y.
Kellogg Mfg. Co., 97 Humboldt, Rochester, N. Y.
Metal Specialties Mfg. Co., 338 N. Kedzie Ave., Chicago.
Macleod Co., 2332 Bogen, Cincinnati, O.
Paasche Air Brush Co., 1911 Diversey Parkway, Chicago, Ill.
Presto. See Metal Specialties Mfg. Co.
Simons Paint Spray Brush Co., 1017 Maryland Ave., Dayton, O.
Simplex Spray Equipment Co., 552 W. Lake, Chicago, Ill.
Sprayit. See Electric Sprayit Co.
Wold Air Brush Mfg. Co., 2173 N. California Ave., Chicago, Ill.
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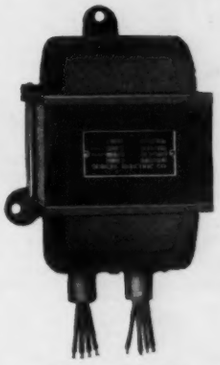

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Cleveland Wire Spring Co., Cleveland, O.
Cook Spring Co., Ann Arbor, Mich.
Cuyahoga Spring Co., Berea Rd., Cleveland, O.
Dunbar Bros. Co., Bristol, Conn.
Eby Mfg. Co., H. H., 4710 Stenton Ave., Philadelphia, Pa.
Farrington & Co., 28 W. Grand, Mt. Vernon, N. Y.
Fischer Spring Co., Chas., 238 Kent Ave., Brooklyn, N. Y.
Gibson Co., Wm. D., 1800 Clybourn Ave., Chicago, Ill.
Hubbard Spring Co., M. D., Pontiac, Mich.
Hunter Pressed Steel Co., Landsdale, Pa.
Lee Spring Co., 34 Main, Brooklyn, N. Y.
Miller & Van Winkle, Inc., 18 Bridge, Brooklyn, N. Y.
Newcomb Spring Corp., 234 40th, Brooklyn, N. Y.
Peck Spring Co., Plainville, Conn.
Peterson Spring Co., 1660 Beard Ave., Detroit, Mich.
Rapid Spring Co., 222 Second Ave., Pittsburgh, Pa.
Raymond Spring Co., Corry, Pa.
Standard Spring and Manufacturing Co., 236-42nd St., Brooklyn, N. Y.
Steinen & Co., 297 Washington, Newark, N. J.
Wallace Barnes Co., Bristol, Conn.
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STAMPED BOXES. See Cabinets, Sheet Steel.
STAMPINGS, Fibre. See Fibre.
Sheet Metal. See Fixture Fittings.
Sheet Steel. See Stampings, Sheet Steel.
Small. See Stampings, Small.

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American Stamping Co., 978 E. 64th, Cleveland, O.
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Janney, Steinmetz & Co., 1421 Chestnut St., Philadelphia.
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Metropolitan Devices Corp., 1250 Atlantic Ave., Brooklyn.
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Truscon Steel Co., Youngstown, O.

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American Radio Hardware Co., 135 Grand, New York, N. Y.
American Stamping Co., 978 E. 64th, Cleveland, O.
Arrow Automatic Products Corp., 27 Vestry, New York, N. Y.
Beaver Mfg. Co., 625 N. Third, Newark, N. J.
Bridgeport Brass Co., 774 E. Main, Bridgeport, Conn.
Bull Dog Electric Products Co., Detroit, Mich.
Chase Brass & Copper Co., Waterbury, Conn.
Clarke Metal Products, Inc., 490 Hancock Ave., Bridgeport, Conn.
Eureka Tool & Machine Co., Newark, N. J.
Faries Mfg. Co., Decatur, Ill.
Geuder, Paeschke & Frey, St. Paul & 15th, Milwaukee.
Grammes & Sons, Inc., L. F., Allentown, Pa.
Gray Bros. Co., Plano, Ill.
Hubbard Spring Co., M. O., Pontiac, Mich.
Hubbell, Inc., Harvey, Bridgeport, Conn.
Kelly Brass Wks., 226 W. Ontario, Chicago, Ill.
Kleinhafer Mfg. Co., 359 Reade, Milwaukee, Wis.
Krischer's Mfg. Co., 255 Calyer, Brooklyn, N. Y.
Lansing Stamping Co., Lansing, Mich.
Lenz Metal Stamping Wks., J., 199 Franklin, New York.
Massachusetts Machine Shop, Inc., Boston, Mass.
Mathews Mfg. Co., 104 Gold, Worcester, Mass.
Mutual. See Bull Dog Elec. Products Co.
Patton-MacGuyer Co., Providence, R. I.
Paul & Beekman Mfg. Co., 1734 N. Fifth, Philadelphia, Pa.
Plume & Atwood Mfg. Co., 474 Bank, Waterbury, Conn.
Premax Products, Inc., Niagara Falls, N. Y.
Quadriga Mfg. Co., 213 W. Grand Ave., Chicago, Ill.
Reliance Die & Stamping Co., 501 N. La Salle, Chicago.
Risdon Mfg. Co., Naugatuck, Conn.
Scovill Mfg. Co., Waterbury, Conn.
Sherman Mfg. Co., H. B., Battle Creek, Mich.
Steinen & Co., 297 Washington, Newark, N. J.
Thomas & Skinner Steel Products Co., 1102 E. 23rd, Indianapolis, Ind.
United Stamping & Mfg. Co., Cleveland, Ohio.
Waterbury Brass Goods Corp., Waterbury, Conn.
Waterbury Button Co., Waterbury, Conn.
Waterbury Mfg. Co., 236 Grand, Waterbury, Conn.
Waterbury Metal Wares Co., Waterbury, Conn.
Zierick Machine Wks., F. R., 6 Howard, New York, N. Y.

STANDS, Armature
Columbia Machine Works & Malleable Iron Co., Atlantic Ave. and Chestnut St., Brooklyn, N. Y.
Electric Service Supplies Co., 17 & Cambria Sts., Philadelphia, Pa.
Onan, David W., 43 Royalstone Ave., Minneapolis, Minn.
Peerless. See Electric Service Supplies Co.
Ridlon Company, Frank, Boston, Mass.
Weidenhoff, Joseph, 4352 Roosevelt Rd., Chicago, Ill.

STARTERS, Motor. See Controllers, Motor; Switches, Remote Control; Switches, Knife; Safety; Switches, Snap (Heavy Duty).
STEATITE. See Cores, Resistance Coil.
STEEL CASTINGS. See Castings, Steel.

STEEL for Electric Appliances
Elyria Iron & Steel Co., Elyria, O.
Ryerson & Son, Jos., 2558 W. 16th, Chicago, Ill.

STEEL, Magnet
Ajax Electrothermic Corp., Trenton, N. J.
Hercules Elec. Steel Corp., 145 Lafayette St., New York.
Indiana Steel Products Co., 4545 S. Western Ave., Chicago.
Ludlum Steel Co., Watervliet, N. Y.

STEEL SHEETS
Agathon. See Central Alloy Steel Corp.
Allegheny Steel Co., Brackenridge, Pa.
American Rolling Mill Co., Middleton, Ohio.
American Sheet & Tin Plate Co., Frick Bldg., Pittsburgh.
Armelec. See Empire Steel Corp.
Central Alloy Steel Corp., Massillon, O.
Cyclops Steel Co., Titusville, Pa.
Dynelec. See Empire Steel Corp.
Empire Steel Corp., Mansfield, O.
Firth-Sterling Steel Co., McKeesport, Pa.
Manelec. See Empire Steel Corp.
Metelec. See Empire Steel Corp.
Newport Rolling Mill Co., Newport, Ky.
Polelec. See Empire Steel Corp.
Republic Iron & Steel Co., 335 Market, Youngstown, O.
Tranelec. See Empire Steel Corp.

Uniloy. See Universal Steel Co.
Universal Steel Co., Bridgeville, Pa.
Wheeling Steel Corp., Wheeling, W. Va.
STEEL, STRIP. See Strip Steel.

STOCKS, Dies and Reamers
Hall-Will, Inc., Erie, Pa.
Ited-E-Hall. See Hall-Will, Inc.
Toledo Pipe Threading Machine Co., 1445 Summit, Toledo, O.

STONES, Commutator
Acme. See Green Equipment Corp.
Caro. See Electric Service Supplies Co.
Cleveland Stone Co., Union Trust Bldg., Cleveland, O.
Co-operative Utilities Co., 15th & Columbia Ave., Philadelphia, Pa.
Diamond Dee. See Co-operative Utilities Co.
Electric Service Supplies Co., 17th and Cambria, Philadelphia, Pa.
Green Equipment Corp., Monadnock Block, Chicago, Ill.
Ideal Commutator Dresser Co., 1039 Park Ave., Sycamore, Ill.
Imperial. See Martindale Electric Co.
Lombard & Co., Somerville, Mass.
Martindale Elec. Co., 1262 W. Fourth, Cleveland, O.

STOOLS, Factory; Steel
Angle Steel Stool Co., Plainwell, Mich.

STORAGE
Battery Plates. See Plates, Storage Battery.
Battery, Separators. See Separaters.
Tools. See Tools, Storage Battery.

STRAINING MACHINES, INSULATION. See Wire Manufacturing Machines.

STRAIGHTENERS, Armature Shaft
Columbia Machine Works & Malleable Iron Co., Atlantic Ave. and Chestnut St., Brooklyn, N. Y.

STRANDING MACHINES. See Wire Manufacturing Machines.

STRIP STEEL
Acme Steel Co., 2840 Archer Ave., Chicago, Ill.
Republic Iron & Steel Co., 335 Market, Youngstown, O.

STRIPPERS, Wire
Acme. See A. Laubscher.
Artos Engineering Co., 69 Wisconsin, Milwaukee, Wis. (Cutting, Stripping and Measuring).
Austin Co., M. B., 108 S. Desplaines, Chicago, Ill.
Dicke Tool Co., Downers Grove, Ill.
E-Z. See Pyramid Products Co.
F. F. See France Mfg. Co.
Foley Saw Tool Co., 655 Foley Bldg., 9 Main, N. E., Minneapolis, Minn. (Bench Type Wire Stripper.)
France Mfg. Co., 10325 Berea Rd., Cleveland. (Motor Driven.)
Goehst. See Klein & Sons.
Hartman. See Service Sales & Mfg. Co.
ives Mfg. Co., Meriden, Conn.
Klein & Sons, Mathias, Chicago, Ill.
Laubscher, A., 77 Fort Pleasant Ave., Springfield, Mass.
Service Sales & Mfg. Co., 17005 Melgrave Ave., Cleveland, Ohio.
Zierick Machine Wks., F. R., 6 Howard, New York City. (Motor Driven Stripper & Twister).

SWITCHBOARD INSTRUMENTS. See Instruments, Portable and Switchboard.
SWITCHBOARDS, SLABS AND BARRIERS
See Asbestos Slabs; Molded Insulation; Slate; Soapstone.

SWITCH (Switches)
Arms. See Posts, Binding.
"Across the Line" Type. See Controllers, Motor.
Baby Knife. See Switches, Battery.
Battery. See Switches, Battery.
Canopy. See Switches, Snap.
Clock Operated. See Switches, Time.
Feed Through. See Switches, Snap.
Fixture. See Switches, Snap.
Float. See Switches, Tank.
Flush. See Switches, Snap.
Handles. See Handles, Wood
Knife, Baby. See Switches, Battery & Baby Knife.
Lever Radio. See Radio Mounting.
Lever. See Switches, Snap, Lever.
Limit. See Controllers, Motor.
Mercury. See Switches, Mercury
Motor Starting. Magnetic Type. See Controllers.
Motor Starting. Non-Magnetic. See Switches, Motor Starting.
Pendant. See Switches, Snap.
Pressure Regulating. See Controllers.
Push Button, Snap. See Switches, Snap.
Push Button, Motor Starting. See Switches, Remote Control.
Radio Receiver. See Radio Mountings.
Range. See Switches Snap; Heavy Duty
Remote Control. See Switches, Remote Control.
Reversing. See Controllers.
Rotary. See Switches, Snap.
Safety. See Switches, Knife.
Snap. See Switches, Snap.
Starter Type. See Controllers.
Storage Battery. See Switches, Storage Battery.
Surface. See Switches, Snap.
Tank. See Switches, Tank.
Time. See Switches, Time.
Toggle. See Switches, Snap.
Tumbler. See Switches, Snap.

SWITCHES, Battery and Baby Knife
Cut-Out Switches.
Anti-Wood. See Keil & Son, Francis.
Bridgeport Switch Co., 209 Center, Bridgeport, Conn.
Bryant Electric Co., Bridgeport, Conn.
Chapman. See Frank W. Morse & Co.
Chicago Elec. Mfg. Co., 2301 S. Halsted, Chicago, Ill.
Chicago-Jefferson Fuse & Elec. Co., 1505 W. 15th, Chicago.
Circle T. See Trumbull Elec. Mfg. Co.
Connecticut Elec. Mfg. Co., Bridgeport, Conn.
Couch Co., S. H., Norfolk Downs, Mass.
Crown. See Edwards & Co., Inc.
Cutler-Hammer Mfg. Co., 1288 St. Paul Ave., Milwaukee.
Diamond H. See Hart Mfg. Co.
Edwards & Co., Inc., 140th & Exterior, New York, N. Y.
Electrad, Inc., 428 Broadway, New York, N. Y.
Eureka. See Frank W. Morse & Co.
Fahnestock Elec. Co., cor. East Ave. and 8th, Long Island City, N. Y.
Handy. See Chicago Elec. Mfg. Co.
H. & H. See Hart & Hegeman Mfg. Co.
Hart Mfg. Co., Hartford, Conn.
Hart & Hegeman Mfg. Co., Hartford, Conn. (Push Button.)
Harwood. See Frank W. Morse & Co.
Heinemann Elec. Co., Philadelphia, Pa.
Jost. See Frank W. Morse & Co.
Kappa. See Trumbull Elec. Mfg. Co.
Keil & Son, Francis, 401 E. 163rd, New York, N. Y.
Kendrick & Davis Co., Lebanon, N. H.
Keystone. See Frank W. Morse & Co.
King Mfg. Co., B. C., 302 Park Ave., Brooklyn, N. Y.
Knox Porcelain Corp., Knoxville, Tenn.
K-P-F Elec. Co., 855 Howard St., San Francisco, Cal.
Kurz & Root, Appleton, Wis.
Leviton Mfg. Co., 226 Newell, Brooklyn, N. Y.

Lyons Mfg. Co. (Mt. Carmel), New Haven, Conn.
Manhattan Elec'l Supply Co., 17 Park Pl., New York, N. Y.
Morse Co., Frank W., Boston, Mass.
Patrick & Wilkins Co., Philadelphia, Pa.
Porcelain Products, Inc., Findlay, Ohio.
Powerlite Switchboard Mfg. Co., 4149 E. 79th, Cleveland, O.
Pullrite. See Frank W. Morse & Co.
Puritan. See S. H. Couch & Co.
Reliable Electric Co., 3145 Carroll Ave., Chicago, Ill.
Samson Electric Co., Canton, Mass.
Spero Elec. Mfg. Co., E. 33rd and Woodland Ave., Cleveland.
Sta-Rite. See Frank W. Morse & Co.
Trumbull Elec. Mfg. Co., Plainville, Conn.
Trumbull-Vanderpoel Elec. Mfg. Co., Bantam, Conn.
Wood Elec. Co., C. D., 565 Broadway, New York, N. Y.

SWITCHES, Mercury
(For Temperature Control Apparatus.)
Absolute Con-Tac-Tor Corp., Elkhart, Ind.
Con-Tac-Tor. See Absolute Con-Tac-Tor Corp.
Cooper Hewitt Electric Co., 410 Eighth, Hoboken, N. J.
Cramblett Engineering Corp., 286 Milwaukee, Milwaukee.
Cutler-Hammer Mfg. Co., 1288 St. Paul Ave., Milwaukee.
Fabrice Thermostatic Control Co., 4750 Sheridan Rd., Chicago, Ill.
General Kontroler Co., 200 E. First, Dayton, O.
Hywatt. See Cramblett Engr. Co.
Kon-nec-tor. See Cooper Hewitt Elec. Co.
Kontax. See General Kontroler Co.
Mercoid Corp., 564 W. Adams, Chicago, Ill.
Safety Regulator Co., 529 S. Mathews, Los Angeles, Cal.

SWITCHES, Motor Starting
Accessible. See Trumbull-Vanderpoel Elec. Mfg. Co.
Aces. See Colt's Patent Fire Arms Mfg. Co.
Adam Elec. Co., Frank, St. Louis, Mo.
Aurora Steel Products Co., Aurora, Ill.
Barber Elec. Mfg. Co., North Attleboro, Mass.
Bull Dog Electric Products Co., Detroit, Mich.
Circle T. See Trumbull Elec. Mfg. Co.
Colt's Patent Fire Arms Mfg. Co., Hartford, Conn.
Columbia Metal Box Co., 226 E. 144th, New York, N. Y.
Crouse-Hinds Co., Syracuse, N. Y.
Diamond C. See Standard Elec. Supply Co.
E. W. See Trumbull Elec. Mfg. Co.
FA. See Adam Elec. Co., Frank.
F. A. Triumph. See Metropolitan Elec. Mfg. Co.
Federal Steel Products Co., 2 Ave. L., Newark, N. J.
Hill. See Mendell Mfg. Co.
Large-Dail Mfg. Co., 606 Cherry, Philadelphia, Pa.
Leonard Elec. Mfg. Co., 2907 Perkins Ave., Cleveland, O.
Lundy Co., E. A., Fulton Bldg., Pittsburgh.
MacMillen Mfg. Co., 1400 N. Spring, Los Angeles, Cal.
Major. See Adam Elec. Co., Frank.
Mason. See Trumbull-Vanderpoel Elec. Mfg. Co.
Mendell Elec. Mfg. Co., Mattapoisett, Mass.
Metropolitan Device Corp., 1250 Atlantic Ave., Brooklyn, N. Y.
Metropolitan Elec. Mfg. Co., Blvd. at 14th, Long Island City, N. Y.
Murray. See Metropolitan Device Corp.
Mutual. See Bull Dog Elec. Products Co.
Naro. See Metropolitan Elec. Mfg. Co.
Noark. See Colt's Patent Fire Arms Mfg. Co.
Nublade. See Colt's Patent Fire Arms Mfg. Co.
Palmer Elec. & Mfg. Co., Waltham, Mass.
Robbins & Myers, Inc., Springfield, O.
Safe-Lock. See Trumbull-Vanderpoel Elec. Mfg. Co.
Safelock. See Westinghouse Elec. & Mfg. Co.
Safuse. See Federal Steel Products Co.
Schmuckler & Sons, 2232 N. 28th, Philadelphia, Pa.
Square D Co., Detroit, Mich.
S. S. See Wadsworth Elec. Mfg. Co.
Standard Elec. Supply Co., 223 N. 13, Philadelphia, Pa.
Tanner & Co., Wm. F., 511 Sharp, Baltimore, Md.
Trumbull Elec. Mfg. Co., Plainville, Conn.
Trumbull-Vanderpoel Elec. Mfg. Co., Bantam, Conn.
T. V. Safelock. See Trumbull-Vanderpoel Elec.
Unisafti. See Metropolitan Device Corp.
Unit-Versal. See Bull Dog Elec. Products Co.
Universal Metal Box & Products Co., 316 Colt, Irvington, N. J.
V. V. Fittings Co., 711 Cherry, Philadelphia, Pa.
Wadsworth Elec. Mfg. Co., Covington, Ky.
Westinghouse Elec. & Mfg. Co., Mansfield, O.
Wiegmann & Co., E. M., 3611 N. 11th, St. Louis.

SWITCHES, Remote Control
Push Button, Magnetically Operated.
Adam Electric Co., Frank, St. Louis, Mo.
Allen-Bradley Co., 493 Clinton, Milwaukee, Wis.
Automatic Switch Co., 154 Grand, New York, N. Y.
Burke Controller Co., 369 Lexington Ave., New York, N. Y.
Clark Controller Co., 1146 E. 152nd, Cleveland, O.
Cramer & Co., R. W., 136 Liberty, New York, N. Y.
Cutler-Hammer Mfg. Co., 1287 St. Paul Ave., Milwaukee.
Diamond H. See Hart Mfg. Co.
Dunco. See Struthers Dunn, Inc.
General Electric Co., Merchandise Dept., Bridgeport, Conn.
Hart Mfg. Co., Hartford, Conn.
H. P. See Palmer Elec. & Mfg. Co.
Industrial Controller Co., Milwaukee, Wis.
Kato Engr. Co., Mankato, Minn.
Major, F. A. System. See Adam Elec. Co.
Monitor Controller Co., 51 S. Gay, Baltimore, Md.
Palmer Elec. & Mfg. Co., Waltham, Mass.
Precise Mfg. Co., 254 Mill, Rochester, N. Y.
Protectoswitch. See Precise Mfg. Co.
R. C. O. C. See South Bend Current Controller Co.
Sauter. See Cramer & Co., R. W.
Signal Engineering & Mfg. Co., 146 W. 14th, New York.
South Bend Current Controller Co., South Bend, Ind.
Struthers Dunn, Inc., 1135 Race, Philadelphia, Pa.
Takamine Corp., 208 Rawson St., Long Island City, N. Y.
Teeple Co., L. R., 540 E. Ninth, Portland, Ore.
Triplock. See Monitor Controller Co.
Trumbull Elec. Mfg. Co., Plainville, Conn.
Zenith Elec. Co., 537 S. Dearborn, Chicago, Ill.

SWITCHES, Snap

	KEY
Feed Through	See p
Fixture (Canopy, Candelabra and Key Arm)	See F
Flush	See f
Lever, Toggle, Tumbler	See L
Pendant	See p
Push Button	See P
Rotary	See R
Surface	See s

See Also Switches, Snap; Heavy Duty.
Adam Electric Co., Frank, St. Louis, Mo. f . . . . . .
Anylite Elec. Co., Ft. Wayne, Ind. L
Arrow Electric Company, Hartford, Conn. f sp P R L F
Arrow Head. See Arrow Elec. Co.
Beaver Mfg. Co., 625 N. Third, Newark, N. J. . . . . f p P . . . . F
Best. See United States Elec. Mfg. Corp.
Brascolite. See Guth & Co., Edwin.
Bremer Elec. Mfg. Co., 139 N. 7th, Philadelphia, Pa. . . . . f . . . . . .

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Tell us what you want and let us build you a sample.
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H-3. 3 wire—non-adjustable
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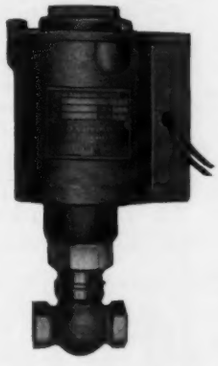

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SHERMAN Battery Clips:—

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Battle Creek, Mich.

SWITCHES, Snap—Continued

Bridgeport Switch Co., 209 Center, Bridgeport, Conn. ..... L F
Bryant Elec. Co., Bridgeport, Conn. ..... f sp P R L F
B. S. Co. See Bridgeport Switch Co.
Carling Tool & Machine Co., 32 Union Place, Hartford, Conn. ..... F
Circle F. Mfg. Co., Trenton, N. J. ..... f .. P .. L F
Circle T. See Trumbull Elec. Mfg. Co.
Connecticut Elec. Mfg. Co., Bridgeport, Conn. ..... p P R L F
Crouse-Hinds Co., Syracuse, N. Y. ..... L ..
Cutler-Hammer Mfg. Co., 1288 St. Paul Ave., Milwaukee, Wis. ..... P .... L ..
Diamond Elec. Mfg. Co., 1330 E. 166th, Los Angeles, Cal. ..... B .. ..
Diamond H. See Hart Mfg. Co.
Dugie. See Bryant Elec. Co.
Economy Fuse Mfg. Co., 2717 Greenview Ave., Chicago, Ill. ..... F
Gaynor Elec. Co., Bridgeport, Conn. ..... f ..... L ..
General Elec. Co., Bridgeport, Conn. ..... f sp P R L F
Glo-Guide. See Bryant Elec. Co.
Gold Star Push Switch. See Hart & Hegeman.
Guth & Co., Edwin, 2615 Washington Ave., St. Louis, Mo. ..... F
Hart Mfg. Co., Hartford, Conn. ..... f sp P R L ..
Hart & Hegeman Mfg. Co., Hartford, Conn. (Door Bolt Control.) ..... f sp P R L F
Hart. See Hart & Hegeman Mfg. Co.
H. & H. See Hart & Hegeman Mfg. Co.
Hubbell, Harvey, Inc., Bridgeport, Conn. .. sp .. .. L F
Jost. See Morse, Frank W.
Keil & Son, Francis, 401 E. 163rd, New York, N. Y. ..... f .. P ..... F
Leviton Mfg. Co., 236 Newell, Brooklyn ..... F
Levoller. See McGill Mfg. Co.
McGill Mfg. Co., Valparaiso, Ind. ..... f ..... L F
Marks Products Co., 80 N. Ninth, Brooklyn, N. Y. ..... L F
Metropolitan Elec. Mfg. Co., Blvd at 14th St., Long Island City, N. Y. ..... s .. R .. ..
Morse Co., Frank W., 291 Congress, Boston ..... P ..... F
National Elec. Controller Co., 5315 Ravenswood Ave., Chicago, Ill. ..... L F
National. See Standard Elec. Mfg. Co.
New England. See Paulding, John L.
Nutmeg. See Hubbell, Harvey, Inc.
Operite. See Morse Co., Frank W.
Pass & Seymour, Solvay Sta., Syracuse, N. Y. ..... f sp P .. L F
Paulding, John L. New Bedford, Mass. ..... f s P ..... F
Pen Tap. See Beaver Mfg. Co.
Perkins. See Bryant Elec. Co.
Pilot Electric Mfg. Co., 323 Berry, Brooklyn, N. Y. ..... L ..
Pilotoggle. See Pilot Elec. Mfg. Co.
Pullrite. See Morse, Frank W.
Ratner Elec. Mfg. Co., 195 Morgan Ave., Brooklyn, N. Y. ..... F
Roberts Elec. Mfg. Co., 2.. Centre, New York, N. Y. ..... F
Rodale Mfg. Co., 200 Hudson, New York p ..... F
Sears, Henry D., 80 Boylston, Boston .. f sp P R L F
Smith & Co., T. C., 3915 Powelton Ave., Philadelphia, Pa. ..... P ..... F
Snapit. See Marks Products Co.
Spartan. See Bryant Elec. Co.
Standard Elec. Mfg. Co., 941 Wrightwood Ave., Chicago, Ill. ..... f s P R L ..
Trigle. See Bryant Elec. Co.
Trumbull Elec. Mfg. Co., Plainville, Conn. f s P R L ..
Twi-Lite. See McGill Mfg. Co.
United States Elec. Mfg. Corp., 232 W. 114th, New York, N. Y. ..... f ..... F
Victor. See Keil & Son, Francis.
Weber. See Sears, Henry D.
Wood Electric Co., C. D., 565 Broadway, New York, N. Y. ..... F
Workrite. See Morse, Frank W.
Yankee. See Bryant Elec. Co.

SWITCHES, Snap; Heavy Duty

Heavy duty rotary snap switches for Electric Range and Small Motor Control.

Arrow Electric Co., Hartford, Conn.
Bryant Electric Co., Bridgeport, Conn.
Burke Controller Co., 269 Lexington Ave., New York, N. Y.
Diamond H. See Hart Mfg. Co.
Domestic Electric Co., 7723 St. Clair Ave., Cleveland, Ohio
General Electric Co., Bridgeport, Conn.
Hart Mfg. Co., Hartford, Conn.
Hart & Hegeman Mfg. Co., Hartford, Conn.

SWITCHES, Storage Battery; Automatic Disconnecting

Cutler-Hammer Mfg. Co., 1288 St. Paul Ave., Milwaukee
Penn Electric Machine Co., Des Moines, Ia.
Radioloc. See Cutler-Hammer Mfg. Co.
Sechrist Mfg. Co., Albert, 1717 Logan, Denver, Colo.

SWITCHES, Tank

Automatic Appliance Co., 226 N. St. Clair, Dayton, Ohio.
Automatic Switch Co., 154 Grand, New York.
Blackburn-Smith Corp., 25 W. 45th, New York, N. Y.
Cutler-Hammer Mfg. Co., 1288 St. Paul Ave., Milwaukee.
Electrical Repair Co., 240 W. 25th, New York, N. Y.
General Electric Co., Schenectady, N. Y.
Industrial Controller Co., S. Pierce & Hanover Sts., Milwaukee, Wis.
Leader-Trahern Products Co., Decatur, Ill.
Ostrander Elec. Wks., W. R., 911 Atlantic Ave., Brooklyn,
Penn Elec. Switch Co., 20th & Walnut, Des Moines, Ia.
Sundh Elec. Co., 209 Parkhurst, Newark, N. J.
Westinghouse Elec. & Mfg. Co., East Pittsburgh, Pa.

SWITCHES, Time (Automatic Clock Operated Switches)

Anderson Mfg. Co., Albert & J. M., 289 A, Boston, Mass.
Astrachron. See Gem Engineering Co.
Automatic Elec. Heater Co., 1505 Race, Philadelphia, Pa.
Automatic Elec. Mfg. Co., Mankato, Minn.
Automatic Lighting Co., 831 Greenmount Ave., Baltimore.
Automatic Sprinkler Corp. of America, 910 B. of L. E. Bank Bldg., Cleveland, Ohio.
Automatic Timer Co., 1841 Euclid Ave., Cleveland, O.
Berry, A. Hall, 73 Murray, New York, N. Y.
Brown & Pengilly, Inc., 1264 Folsom, San Francisco, Cal.
Cackle. See Berry A. Hall.
Campbell Electric Mfg. Co., 15 Stewart, Lynn, Mass.
Clark. See Automatic Heater Co.
Cleveland. See D. J. Time Switch Co.
Con-tac-tor. See Absolute Con-tac-tor Corp.
Cramer & Co., R. W., 136 Liberty, New York, N. Y.
Diamond Elec. Mfg. Co., 1330 E. 16th, Los Angeles, Cal.
D-J Time Switch Co., 1306 E. 14th, Cleveland, O.
Eureka Tool & Machine Co., 42 Walnut, Newark, N. J.
Frisch, Walter P., 104 Linden, Rochester, N. Y.
Gem Engineering Co., Hempstead, N. Y.
General Electric Co., Schenectady, N. Y.

Go-N-Set. See G. & S. Research Lab.
G. & S. Research Laboratory, 1269 Cochran Ave., Los Angeles, Cal.
Hart Mfg. Co., Hartford, Conn.
Hartford. See Berry A. Hall.
Horni Signal Mfg. Co., 290 Hudson, New York, N. Y.
Knowles, W. E., 2869 Broadway, Oakland, Cal.
Kwixset. See Thompson Clock Co.
Lamp-Lighter. See Robbins & Myers Co.
Liberty Bell Mfg. Co., Minerva, Ohio.
Mercury Time Switch Co., Marine City, Mich.
Northwestern Clock Co., Omaha, Neb.
Ohio Time Switch Co., 1439 St. Clair Ave., Cleveland.
Paragon Elec. Co., 409 S. Dearborn, Chicago, Ill.
Racine. See Reliance Automatic Ltg. Co.
Radio Owl, 2269 E. 51st, Los Angeles, Cal.
Reliance Automatic Ltg. Co., 1925 Meade, Racine, Wis.
Research Mfg. Laboratory, 1269 Cochran Ave., Los Angeles,
Robbins & Myers Co., Springfield, O.
Ross Safety Switch Corp., 1 E. 42nd, New York, N. Y.
Sauter. See Cramer & Co.
States Co., Hartford, Conn.
Thompson Clock Co., H. C., Bristol, Conn.
Tork Clocks, Inc., 12 E. 41st, New York, N. Y.
Zenith Elec. Co., 537 S. Dearborn, Chicago, Ill.

TACHOMETERS

Speed Indicators, Speedometers, Revolution Counters.

Belden Mfg. Co., 2310B S. Western Ave., Chicago, Ill.
Biddle, James G., 1211 Arch, Philadelphia, Pa.
Brown Instrument Co., Wayne & Windrim, Philadelphia.
Comet Elec. Co., 47 Union Trust Bldg., Indianapolis, Ind.
Durant Mfg. Co., 655 Buffum, Milwaukee, Wis.
Electric Tachometer Corp., 310 N. 11th, Philadelphia, Pa.
Holtzer-Cabot Elec. Co., Boston, Mass.
Leeds & Northrup Co., 4901 Stenton Ave., Philadelphia, Pa.
Productimeter. See Durant Mfg. Co.
Standco. See Sticht & Co.
Sticht & Co., H. H., 13 Park Row, New York, N. Y.
Veeder Mfg. Co., 14 Sargeant, Hartford, Conn.
Weston Elecl. Instrument Co., 582 Frelinghuysen Ave., Newark, N. J.

TAGS, Cable; Pole and Battery

American Radio Hardware Co., 135 Grand, New York, N. Y. (Battery Lead Tags.)
Benedict Mfg. Co., East Syracuse, N. Y.
Brooklin Underground Elec'l Mfg. Co., Glenside, Pa.
Crowe Name Plate & Mfg. Co., 1749 Grace, Chicago, Ill.
Grammes & Sons, Inc., L. F., Allentown, Pa.
International Tag Co., 319 N. Whipple, Chicago, Ill.
Premax Products, Inc., Niagara Falls, N. Y.
Viking Tool & Machine Co., 745 65th, Brooklyn, N. Y.
Waterbury Button Co., Waterbury, Conn.

TAGS, Shipping

Campbell Paper Box Co., South Bend, Ind.
International Tag Co., 319 W. Whipple, Chicago, Ill.

TANK SWITCHES. See Switches, Tank.
TANKS, TINNING. See Wire Manufacturing Machines.

TAPE, Asbestos

American Asbestos Co., Norristown, Pa.
Asbestos Fibre Spinning Co., North Wales, Pa.
General Asbestos & Rubber Co., Charleston, S. C.
Johns-Manville Corp. (Elec'l Dept.), New York, N. Y.
Mitchell-Rand Mfg. Co., 19 Vesey, New York, N. Y.
Niagrite. See Johns-Manville, Inc.
Shield Brand. See Mitchell-Rand Mfg. Co.

TAPE, Cotton, Linen, Silk; Tape, Sleeving, Webbing.

Anchor Webbing Co., Nye, Pawtucket, R. I. (Cotton, Silk.)
Awabco. See Anchor Webbing Co.
Belden Mfg. Co., 2310B S. Western Ave., Chicago, Ill.
Beldentape. See Belden Mfg. Co.
Eagle. See Sidebotham, Inc., John.
General Electric Co., Schenectady, N. Y.
Glimer Co., L. H. (Tacony), Philadelphia, Pa.
Hope Webbing Co., 1005 Main, Providence, R. I.
Krout & Pite Mfg. Co., Allegheny Ave. & Emerald, Philadelphia, Pa.
Mitchell-Rand Mfg. Co., 19 Vesey, New York, N. Y.
Pearce Co., R. T., Covington, Ky.
Shield Brand. See Mitchell-Rand Mfg. Co.
Sidebotham, Inc., John, 4317 Griscom, Philadelphia, Pa.
Smith Belting Co. (Germantown), Philadelphia, Pa.
Superfine. See Windsor Webbing Co.
Westinghouse Elec. & Mfg. Co., East Pittsburgh, Pa.
Windsor Webbing Co., Pawtucket, R. I.
Worcester Braiding Co., 34 Southbridge, Worcester, Mass.

TAPE, Mica

Chicago Mica Co., Valparaiso, Ind.
Mica Insulator Co., 200 Varick, New York, N. Y.
Mica Mfg. Co., 135 Johnson, Brooklyn, N. Y.
Mitchell-Rand Mfg. Co., 19 Vesey, New York, N. Y.
Westinghouse Elec. & Mfg. Co., East Pittsburgh, Pa.

TAPE, Rubber and Friction

Ackerman. See Ackurate Rubber Co.
Ackurate Rubber Co., 25 Beaver St., New York, N. Y.
Adamson & Co., Joseph, Columbia and Germantown Aves., Philadelphia, Pa.
Adhere. See Westinghouse Elec. & Mfg. Co.
Alpha. See Johns-Manville, Inc.
Amazon. See Graybar Elec. Co.
Appleton Rubber Co., Franklin, Mass.
Armature-White. See Boston Woven Hose & Rubber Co.
Black Diamond. See Dunton Co., M. W.
Boston Woven Hose & Rubber Co., P. O. Box 5077, Boston, Mass.
Brooklyn. See Johns-Manville, Inc.
Bull-Dog. See Boston Woven Hose & Rubber Co.
Canfield Rubber Co., Bridgeport, Conn.
Canton. See Plymouth Rubber Co.
Clifton. See Clifton Mfg. Co.
Clifton Mfg. Co., 65 Brookside Ave., Boston 30, Mass.
Competition. See New York Insulated Wire Co.
Double-Wear. See Dryden Rubber Co.
Dryden Rubber Co., 1014 S. Kildare Ave., Chicago, Ill.
Dundee, A. & B. See Okenite Co.
Dunton Co., M. W., 670 Eddy St., Providence, R. I.
Dutch-Brand. See Van Cleef Bros.
Elkhart Rubber Wks., Elkhart, Ind.
Evergrip. See Boston Woven Hose & Rubber Co.
Firestone Tire & Rubber Co., Akron, O.
Fisenzel Elec. Co., Merchandise Dept., Bridgeport, Conn.
Graybar Elec. Co., Graybar Bldg., Lexington Ave. & 43rd St., New York, N. Y.
Grimshaw. See New York Insulated Wire Co.

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Holdfast Ruober Co., Atlanta, Ga.
Holdtite. See United States Rubber Co.
Hydro-Proof. See Elkhart Rubber Wks.
Imperial Rubber Co., 220 Broadway, New York, N. Y.
Imperva. See Canfield Rubber Co.
Irco. See Imperial Rubber Co.
Johns-Manville Corp. (Elec'l Dept.), New York, N. Y.
Jomanco. See Johns-Manville, Inc.
Kerite Ins. Wire & Cable Co., 30 Church, New York, N. Y.
Magnet. See Boston Woven Hose & Rubber Co.
Manson. See Okonite Co.
New York Insulated Wire Co., 114 Liberty, New York, N. Y.
Okonite Co., Passaic, N. J.
O. K. See Appleton Rubber Co.
P. & B. See Ruberoid Co.
Paratex. See Appleton Rubber Co.
Paruco. See Passaic Rubber Co.
Passaic Rubber Co., Clifton, N. J.
Plymouth Rubber Co., 1400 Revere, Canton, Mass.
Red-X. St. Louis Rubber Cement Co.
Relic. See United States Rubber Co.
Ruberoid Co., 95 Madison Ave., New York, N. Y.
S. I. See Superior Insulating Tape Co
Security. See United States Rubber Co.
Service. See Boston Woven Hose & Rubber Co.
Slipknot. See Plymouth Rubber Co.
St. Louis Rubber Cement Co., 3952 West Pine, St. Louis.
Star. See Sullivan & Sons Mfg. Co., J.
Sticka. See Graybar Elec. Co.
Stixwell. See Clifton Mfg. Co.
Sullivan & Sons Mfg. Co., J., 2224 N. 9th, Philadelphia, Pa.
Superior Insulating Tape Co., 3044 Lambdin Ave., St. Louis.
2-Plex. See Holdfast Rubber Co.
U. S. See United States Rubber Co.
United States Rubber Co., 1790 Broadway, New York, N. Y.
Van Cleef Bros., 7722 Woodlawn Ave., Chicago.
Victor. See Graybar Elec. Co.
Westinghouse Elec. & Mfg. Co., East Pittsburgh, Pa.

TAPE, Varnished Fabric

Acme Wire Co., New Haven, Conn.
Belden Mfg. Co., 2310B S. Western Ave., Chicago, Ill.
General Electric Co., Merchandise Dept., Bridgeport, Conn.
Irvington Varnish & Insulator Co., Irvington, N. J.
Mica Insulator Co., 200 Varick, New York, N. Y.
Mitchell-Rand Mfg. Co., 19 Vesey, New York, N. Y.
New Jersey Wood Finishing Co., Woodbridge, N. J.
Radiotape. See Respro, Inc.
Respro, Inc., Wellington Ave. (Auburn), Providence, R. I.
Shield Brand. See Mitchell-Rand Mfg. Co.
Sico. See Standard Insulator Co.
Standard Insulation Co., East Rutherford, N. J.
Voltape. See Respro, Inc.

TAPING MACHINES, Coil

Chapman Electric Works, P. E., 1820 Chouteau Ave., St. Louis, Mo.
Columbia Machine Works & Malleable Iron Co., Atlantic Ave. and Chestnut St., Brooklyn, N. Y.
Electric Service Supplies Co., 17th & Cambria Sts., Philadelphia, Pa.
Griswold Machine Co., George, New Haven, Conn.
Ridlon Company, Frank, Boston, Mass.
Segur. See Electric Service Supplies Co.

TAPING MACHINES, Wire

American Insulating Machinery Co., 519 Huntington Ave., Philadelphia, Pa.
Wire Machinery Corp. of Am., New Haven, Conn.

TAPS. See Stocks, Dies and Reamers.
TENSION DEVICES, Coil Wire. See Racks, Wire Reel.

TENSION MACHINES, Band Wire

Electric Service Supplies Co., 17th & Cambria Sts., Philadelphia, Pa.
Peerless. See Electric Service Supplies Co.

TERMINALS AND CONNECTORS

Low Tension, Secondary Terminals and Connectors.

All-in-One. See Ohio Parts Co.
Barey-Nicholson Co., 2801 Fort, W., Detroit, Mich.
Bassett Metal Goods Co., Derby, Conn. (General Selling Agent, Hatheway & Co., 16 Hudson, New York, N. Y.)
Belden Mfg. Co., 2310B S. Western Ave., Chicago, Ill.
Burton-Rogers Co., Boston, Mass.
Cabelug. See Jones, Howard B.
Clark Metal Products, 490 Hancock Ave., Bridgeport.
Dante Elec'l Mfg. Co., Bantam, Conn.
Dixie Supply Co., 91 7th Ave., New York.
Double Grip. See Pons, Eugene
Eagle Elec. Mfg. Co., Dept. ER4, 59 Hall, Brooklyn, N. Y.
Electron. See Bassett Metal Goods Co.
Fahnestock Elec. Co., East Ave. and 8th, Long Island City, N. Y.
Fleron & Son, M. M., 113 N. Broad, Trenton, N. J.
Grammes & Sons, Inc., L. F., Allentown, Pa.
Ideal Clamp Mfg. Co., 198 Bradford, Brooklyn, N. Y.
Jones, Howard B., 2226 Wabansia, Chicago, Ill.
K. E. M. See Kulier Elec. Mfg. Co.
Kulier Elec. Mfg. Co., 575 Pierce Ave., Long Island City.
Morse Co., Frank W., Boston, Mass.
Nu-Way Snap. See Hatheway Mfg. Co.
Ohio Parts Co., 3301 Colerain Ave., Cincinnati, O.
Orum, S. R. M., 503 N. 11th, Philadelphia, Pa.
Patton-MacGuyer Co., Providence, R. I.
Pons, Eugene, 927 Campbell Ave., Schenectady, N. Y.
Peterson Co., 7 Beverly, Providence, R. I.
Rajah Co., Bloomfield, N. J.
Salem Elec'l Supply Co., Salem, Mass.
Sherman Mfg. Co., H. B., Battle Creek, Mich.
Shure. See Burton-Rogers Co.
Tinkerbox. See Weber Elec. Wks.
Waterbury, Button Co., Waterbury, Conn.
Weber Elec. Wks., Brooklyn Sts., Cleveland, O.
Zierick Machine Wks., F. R., 6 Howard, New York.

TEST BENCHES, Armature

Allen Electric & Equipment Co., Kalamazoo, Michigan.
Burton & Rogers Co., Boston, Mass.
Cowie Electric Co., E. S., 1816 McGee, Kansas City, Mo.
Electric Machine Corp., 529 S. N. J., Indianapolis, Ind.
Hobart Bros. Co., Troy, Ohio.
Marshall Elec. Co., Elkhart, Ind.
Miho Company, 717 Sycamore, Cincinnati, Ohio.
North East Electric Co., Rochester, N. Y.
Pence & Son, H. O., San Luis Obispo, Cal.
Weidenhoff, Joseph, 4252 W. Roosevelt Road, Chicago, Ill.

TESTING INSTRUMENTS. See Instruments.

TESTERS, Coil

(Includes Armature Growlers, trouble shooters, and other portable testing devices). See also Instruments

Ace. See Weidenhoff, Joseph.
Allen-Bradley Company, 493 Clinton, Milwaukee, Wis.
Allen Electric & Equipment Co., Kalamazoo, Michigan.
Ankenbrandt, J. J., G Dept., 2140 Wakeman, Toledo, Ohio.
Armeter. See Chapman Electric Works, P. E., 1820 Chouteau Ave., St. Louis, Mo.
Bartlett Electric Products Co., Goshen, Ind. (Storage Battery).
Batt-O-Meter. See Indiana Mfg. & Elec. Co.
Burton & Rogers Co., 857 Boylston, Boston, Mass.
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Colpin Corp., 6110 S. Main, Los Angeles, Cal.
Columbia. See Weidenhoff, Joseph.
Comparometer Co., New Ulm, Minn.
Cowie Electric Co., E. S., 1816 McGee, Kansas City, Mo.
Economy. See Weidenhoff, Joseph.
Electric Controller & Mfg. Co., 2700 E. 79th, Cleveland.
Electric Machine Corp., 529 S. N. J., Indianapolis, Ind.
Electrotest. See Comparometer Company.
Elmco. See Electric Machine Corp.
Ev-Ri-Test. See Weidenhoff, Joseph.
Forest Electric Co., 272 New, Newark, N. J.
Ga-Jit. See General Instrument Corp.
General Instrument Corp., 477 Broadway, New York, N. Y.
Hobart Bros. Co., Troy, Ohio.
Ideal. See Ankenbrandt, J. J.
Indiana Mfg. & Electric Co., Marion, Indiana.
Kletzman Electrical Mfg. Co., 234 N. Central, Gilman, Ill.
Leich Electric Co., Genoa, Ill.
Lundin Electric Machine Co., 10 Thacher, Boston, Mass.
Mallory Electric Co., Factories Bldg., Toledo, Ohio.
Marshall Elec. Co., Elkhart, Ind.
Meco. See Metropolitan Mfg. & Elec. Co.
Metropolitan Mfg. & Elec. Co., 1163 Sedgwick, Chicago, Ill.
Milso Company, 717 Sycamore, Cincinnati, Ohio.
North East Electric Co., Rochester, N. Y.
Onan, David W., 43 Royalstone Ave., Minneapolis, Minn.
Paneltest. See Forest Electric Co.
Portometer. See Forest Electric Co.
Portostat. See Forest Electric Co.
Presto. See Metal Specialties Mfg. Co.
Reliable Parts Mfg. Co., Wellington, Ohio.
Rex Batrystat. See Bardlett Products Co.
Scout. See Leich Electric Company.
Serwell Sales Corp., 1749 N. Winchester Ave., Chicago, Ill.
Test-All. See Colpin Corp.
Test-O-Meter. See Weidenhoff, Joseph.
Test-Rite. See Colpin Corp.
Victory. See Weidenhoff, Joseph.
Weidenhoff, Joseph, 4352 W. Roosevelt Rd., Chicago, Ill.

TESTING LABORATORIES

Elec'l Testing Laboratories, 80th St. and East End Ave., New York, N. Y.
National Elec'l Inst. Co., 162 Sidney, Cambridge, Mass.
New York Testing Laboratories, 80 Washington, New York.
Rubicon Co., 29 N. Sixth, Philadelphia, Pa.
Stupakoff Laboratories, 6617 Hamilton Ave., Pittsburgh, Pa.

THERMO JUNCTIONS. See Instruments, Laboratory Standard.

THERMOSTATIC METAL

Chace Valve Co., W. M., 1600 Beard Ave., Detroit, Mich.
Coffin Mfg. Co., B. F., 30 Court, Newark, N. J.
Cook Plate Co., Edw. N., 70 Ship, Providence, R. I.
Improved Seamless Wire Co., 775 Eddy, Providence, R. I.
Interstate Products Corp., 29 Commercial, Newark, N. J.
Wilco. See H. A. Wilson Co.
Wilson Co., H. A., 97 Chestnut, Newark, N. J.

THERMOSTATS

Absolute Con-Tac-Tor Corp., Elkhart, Ind.
American Thermostat Co., 226 Jelliff Ave., Newark, N. J.
Automatic Appliance Co., Jackson, Mich.
Bak-Rite. See Electric Appliance Mfg. Co.
Boston Machine Wks. Co., 7 Willow, Lynn, Mass.
Brown. See Electric Automatic Appliance Co.
Brown Instrument Co., Wayne & Windrim, Philadelphia, Pa.
Burke Controller Co., 369 Lexington Ave., New York, N. Y.
Cobb Elec. Appliance Co., 2 Lanesville Ave., Boston, Mass.
Coffin Mfg. Co., B. F., 30 Court, Newark, N. J.
Cramblet Engineering Corp., 286 Milwaukee, Milwaukee, Wis.
Diamond H. See Hart Mfg. Co.
Electric Automatic Appliance Co., Denver, Colo.
Electric Heat Control Co., 5902 Carnegie Ave., Cleveland, O.
Electric Maid. See Hankscraft Co.
Fabrice Thermostatic Control Co., 4750 Sheridan Rd., Chicago, Ill.
Globe Mfg. Co., Battle Creek, Mich.
Hankscraft Co., 615 E. Washington, Madison, Wis.
Hart Mfg. Co., Hartford, Conn.
Hi-Lo. See Boston Machine Wks. Co.
Hynes & Cox Elec. Corp., 406 N. Pearl, Albany, N. Y.
Interstate Products Corp., 29 Commercial, Newark, N. J.
King. See Electric Heat Control Co.
Leachwood Co., Janesville, Wis.
Manhattan Elec'l Supply Co., New York, N. Y.
Marvel. See American Thermostat Co.
Mercoid Corp., 564 W. Adams, Chicago, Ill.
Moeller, A. E., 261 Sumpter, Brooklyn, N. Y.
Midget. See Coffin Mfg. Co., B. F.
National Steel Construction Co., 425 Fountenac, Seattle, Wash.
Pyratherm. See Federal Gauge Co.
Savutime Devices, Inc., 88 Manhattan, Rochester, N. Y.
Sensatherm. See Mercoid Corp.
Standard Thermometer Co., 65 Shirley, Boston 19, Mass.
Tagliabue Mfg. Co., C. J., 18 33rd, Brooklyn, N. Y.
Teeple Co., L. R., 540 E. 9th, Portland, Ore.
Thermocap. See Spencer Thermostat Co.
Trent Co., Harold E., 439 N. 12th, Philadelphia, Pa.
Visaflame. See Mercoid Corp.

TIGHTENERS, Commutator

Elmes Engineering Works, Chas. F., 222 N. Morgan, Chicago, Ill.

TIME SWITCHES. See Switches, Time.

TINNING TANKS, WIRE. See Wire Manufacturing Machines.

TINSEL. See Wire, Insulated.

TIPS, Cord

Alden Mfg. Co., Brockton, Mass.
Belden Mfg. Co., 2310B S. Western Ave., Chicago, Ill.
Beldentube. See Belden Mfg. Co.
Duro. See McEvoy, C. H.
McEvoy, C. H., 430 Broadway, Lowell, Mass.
Na-Ald. See Alden Mfg. Co.
National Acme Mfg. Co., 7500 Stanton Ave., Cleveland, O.
Norden & Co., S. 415 Saunton, Providence, R. I.
Rome Wire Co., Div. of General Cable Corp., Rome, N. Y.
Waterbury Brass Goods Corp., Waterbury, Conn.

TOOLS, Commutator Slotting. See Slotting Machines & Tools, Commutator.

TOOLS, Commutator Truing

Acme. See Green Equipment Corp.
Allen Elec. & Equipment Co., N. Pitcher St., Kalamazoo, Mich.
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Jordan Bros., 74 Beekman, New York, N. Y.
Martindale Elec. Co., 1262 W. Fourth, Cleveland, Ohio.

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Battery Equipment & Supply Co., 7530 Greenwood Ave., Chicago, Ill. Burning Racks, Battery Trucks, Plate Pressers, Mallets, Lead Burners and Strainers.
Battery Parts Co., Inc., Wilkinsburg, Pa. (Leads.)
Battery Tools Co., 29 Willow, Montclair, N. J.
Besco. See Battery Equipment & Supply Co.
Bobbett Elec. Mfg. Co., 811 E. 43rd St., Chicago, Ill. (Knife Heaters.)
Canedy-Otto Mfg. Co., 1816 McGee, Chicago Heights, Ill. (Floor Vises.)
Cowie Elec. Co., 1823 Wyandotte, Kansas City, Mo. (Jar Lifting Pliers.)
General Elec. Co., Schenectady, N. Y. (Lead Burning Outfits.)
Ibsco. See Illinois Battery Steamer Co.
Illinois Battery Steamer Co., Peoria, Ill.
Ohio Parts Co., 3301 Colerain Ave., Cincinnati. (Terminals.)
Op-al Elec. & Mfg. Co., 1057 E. 30th St., Indianapolis, Ind. (Knife Heaters.)
Orum, S. R. M., 503 N. 11th, Philadelphia, Pa. (Pillar Post Sleeves, Tongs, Reamers, Strap Punches, Terminal Pullers, Steamers, Racks or Stands, Terminal Post Shapers, Battery Analyzer, Post Sealing Machine, Plate Burning Press, Press and Stands.)
Pyratip. See General Elec. Co.
Reliable Parts Mfg. Co., Wellington, O. (Steamer and Still, Filler, Separator Cutter, Clips, Carrier, Post Cutter, Terminal and Cell Puller.)
Thompson Mfg. Co., Meadville, Pa. (Reamers, Terminal Post Pullers, Pressing Tongs.)

TORCHES AND FURNACES

Acetylene, Alcohol, Gasoline, Kerosene.
Berns Co., Otto, Newark, N. J.
Clayton & Lambert Mfg. Co., Detroit, Mich.
Dreadnaught. See Wall Mfg. Supply Co.
Klein & Sons, Mathias, Chicago, Ill.
Lasher-Peerblow Co., 237 Harrison Ave., Boston, Mass.
McGill Mfg. Co., Valparaiso, Ind.
Peerless. See Lasher-Peerblow Co.
Staysalite. See Klein & Sons, Mathias.

TORPEDO Cord. See Twine.

TORSION BALANCES. See Instruments, Laboratory Standard.

TRANSFORMERS
Radio. See Radio Circuit Components.
Gas Tube Sign. See Transformers, Oil Burner.
Oil Burner Ignition. See Transformers, Oil Burner.

TRANSFORMERS, Low and Intermediate Voltage

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American Transformer Co., Newark, N. J.
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Chicago-Jefferson Fuse & Elec. Co., 1505 W. 15th, Chicago.
Dongan Elec. Mfg. Co., 2985 Franklin, Detroit, Mich.
General Electric Co. (Merchandise Dept.), Bridgeport, Conn.
Manhattan Elecl. Supply Co., 17 Park Pl., New York, N. Y.
Sorgel Electric Co., 89 W. Water, Milwaukee, Wis.
Standard Transformer Co., Warren, O.
Thordarson Elec. Mfg. Co., 500 W. Huron, Chicago, Ill.
Uptigraff Mfg. Co., R. E., First National Bank Bldg., Pittsburgh, Pa.
Ward Leonard Elec. Co., Mt. Vernon, N. Y.
Webster Electric Co., Racine, Wis.

TRANSMISSION DRIVES. See Chain, Transmission.

TRANSMITTERS, Power

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Electric Service Supplies Co., 17th & Cambria Sts., Philadelphia, Pa.
Segur. See Electric Service Supplies Co.

TROUBLE FINDERS. See Instruments, Portable and Switchboard; also Testers, Coil.

TRUCKS, Armature. See Lifts, Armature.

TRUCKS, Factory Steel

Angle Steel Stool Co., Plainwell, Mich.

TRUING Devices, Commutator. See Tools, Commutator.

TUBE (Tubes) (Tubing) Adapters. See Radio Receiver Parts.
Brass. See Tubing, Brass.
Condenser. See Tubing, Brass and Copper.
Copper. See Tubing, Brass.
Cutters. See Stocks, Dies, etc.
Fibre. See Fibre.
Fibre Candle. See Candles.
Mica. See Mica.
Paper. See Tubes, Paper.
Platinum. See Platinum.
Pyrometer. See Cores, Resistance.
Refractory. See Cores, Resistance.
Radio. See Radio Vacuum Tubes.
Varnished Fabric. See Tubing, Varnished Fabric.

TUBES, Paper; Cores; Sleeves, Bushings

Cleveland Container Co., 10800 Berea Rd., Cleveland, O.
Climax Tube Co., Mystic, Conn.
Klimaxcore. See Climax Tube Co.
McCausland, J. E., 86 Valley, Providence, R. I.
Pairpoint Corp., New Bedford, Mass.
Reliable Elec. Co., 3145 Carroll Ave., Chicago, Ill.
Remington Mfg. Co., 939 Barnum Ave., Bridgeport, Conn.
Standard Underground Cable Co., Div. of General Cable Corp., Pittsburgh, Pa.
Stone Paper Tube Co., 33 O. N. E., Washington, D. C.
Textile Tube Co., Fall River, Mass. (Paper Sleeves.)

TUBING, Brass and Copper

American Brass Co., 25 Broadway, New York, N. Y.
Anaconda. See American Brass Co
Baltimore Tube Co., Baltimore, Md.
Bridgeport Brass Co., Bridgeport, Conn.
British American Tube Co., 233 Broadway, New York.
Bull Dog. See British American Tube Co.
Chase Brass & Copper Co., Waterbury, Conn.
Conklin Brass & Copper Co., T. E., 54 Lafayette, New York.
French Mfg. Co., 128 Robbins, Waterbury, Conn.
Mueller Brass Co., Port Huron, Mich.
National Copper & Smelting Co., 1395 Coltman Rd., Cleveland, O.
Randolph Clowes Co., Waterbury, Conn.
Relleum. See Mueller Brass Co.
Roberts Tube Works, 2500 Military Ave., Detroit, Mich.
Rome Brass & Copper Co., Rome, N. Y.
Rome Hollow Wire & Tube Co., Rome, N. Y.
Rome Turney Radiator Co., Rome, N. Y.
Scovill Mfg. Co., Waterbury, Conn.
Standard Underground Cable Co. (Div. of General Cable Corp.), Pittsburgh, Pa.
Summerill Tubing Co., Bridgeport, Pa.
Torrington Mfg. Co., Torrington, Conn.
United Wire & Supply Co., 1497 Elmwood Ave., Providence.
Wells Co., A. H., Watertown Ave., Waterbury, Conn.
Wolverine Tube Co., 1433 Central Ave., Detroit, Mich.

TUBING, Flexible Metallic

Almond Mfg. Co., T. R., Ashburnham, Mass.
American Metal Moulding Co., 146 Colt St., Irvington, N. J.
Auto-Brassflex. See National Metal Molding Co.

Auto-Steelflex. See National Metal Molding Co.
Breeze Metal Hose & Mfg. Co., 24 S. 6th, Newark, N. J.
Fischer Spring Co., Chas., 228 Kent Ave., Brooklyn, N. Y.
Leachwood Co., Janesville, Wis.
National Elec. Products Corp., 1110 Fulton Bldg., Pittsburgh, Pa.
Riflex. See United Metal Hose Co.
Sleeper & Hartley, Inc., Worcester, Mass.
Titeflex Metal Hose Co., Newark, N. J.
Triangle Conduit Co., Dry Harbor Rd. and Cooper Ave., Brooklyn, N. Y.
United Metal Hose Co., 724 Garrison Ave., New York, N. Y.
White Dental Mfg. Co., S. S., 152 W. 42nd, New York.

TUBING, Rubber

Rubber Tubing for Insulating Wire in Instruments and Telegraph Signal Lines.
Faultless Rubber Co., Ashland, O.
Forest City Rubber Co., 1276 Ontario, Cleveland, O.
Goodrich Rubber Co., B. F., Akron, O.
Tyler Rubber Co., Andover, Mass.
Vulcanized Rubber Co., 251 Fourth Ave., New York, N. Y.

TUBING, Varnished Fabric

Insulating Tubing—Spaghetti.
Aeme Wire Co., New Haven, Conn.
Alpha Radio Supply Co., 520 Broadway, New York, N. Y.
Belden Mfg. Co., 2310B S. Western Ave., Chicago, Ill.
Bentley-Harris Mfg. Co., Conshohocken, Pa.
Brand & Co., Wm., 268 Fourth Ave., New York, N. Y.
Empire. See Miles Insulator Co.
General Electric Co. (Merchandise Dept.), Bridgeport, Conn.
Goodrich Rubber Co., B. F., Akron, O.
Insulated Duct & Cable Co., Stokes, Trenton, N. J.
Insuline Corp. of America, 78 Cortlandt, New York, N. Y.
Irvington Varnish & Insulator Co., Irvington, N. J.
Lee Tire & Rubber Co., Conshohocken, Pa.
Mica Insulator Co., 200 Varick, New York, N. Y.
Mitchell-Rand Mfg. Co., 19 Vesey, New York, N. Y.
Pearce Co., R. T., Covington, Ky. (Insulated Waxed Cotton.)
Turbo. See Brand & Co.
Varflex Corp., Rome, N. Y.

TURNED-UP BOXES AND CABINETS. See Cabinets, Sheet Steel.

TWINE, Armature Winding; Torpedo Cord

Belden Mfg. Co., 2310B S. Western Ave., Chicago, Ill.
Mitchell-Rand Mfg. Co., 19 Vesey, New York, N. Y.
Wirne & Son, Frank W., 42 N. Front, Philadelphia, Pa.

UNDERCUTTERS, Mica. See Slotting Machines & Tools, Commutator.

UNITS, Refrigerator Condenser. See Condenser Units, Refrigerator.

UNITS, Rods and Grids, Resistance

Acme Elec. Heating Co., Dept. R, 1217 Washington, Boston.
Allen-Bradley Co., 493 Clinton, Milwaukee, Wis.
Automatic Electric Heater Co., 1706 Race, Philadelphia, Pa.
Bradleyunit. See Allen Bradley Co.
Buffalo Products Co., Broome & Lafayette Sts., New York.
Burger, J. P., 1813 Columbus Rd., Cleveland, O.
Calrod. See Edison Elec. Appliance Co.
Carter Radio Co., 2422 Prospect Ave., Chicago, Ill.
Chromalax. See Edwin L. Wiegand Co.
Clark Controller Co., 1146 E. 152nd, Cleveland, O.
Crown Coloring & Chemical Co., 33 W. 17th, New York.
Cutler-Hammer Mfg. Co., 1288 St. Paul Ave., Milwaukee.
Dalton Elec. Heating Co., 287 Bridge St., Salem, Mass.
Dalton-Marsh Co., 88 Holten, Danvers, Mass.
Darle Co., 35 E. 21st, New York, N. Y.
Di-El-Ite. See Wirt Co.
Dixon Crucible Co., Jos., Jersey City, N. J.
Eagle Elec. Mfg. Co., 59 Hall, Brooklyn, N. Y.
Edgewound. See Monitor Controller Co.
Edison Electric Appliance Co., 5600 W. Taylor, Chicago, Ill.
Elec. Controller & Mfg. Co., 2700 E. 79th, Cleveland, O.
Electro Thermal-Unit Co., 44 N. Fourth, Philadelphia, Pa.
Elemite. See Louthan Mfg. Co.
Farrington & Co., Inc., 28 W. Grand, Mt. Vernon, N. Y.
Fits-All. See Eagle Elec. Mfg. Co.
Fitz-All. See Rodale Mfg. Co.
Fitz-Rite. See Rodale Mfg. Co.
Fix-All. See Witlow Elec. Mfg. Co.
F & M. See Hiram Marks Elec. Co.
General Electric Co., Schenectady, N. Y.
Globar Corp., Niagara Falls, N. Y.
Glo-Well. See Eagle Elec. Mfg. Co.
Gold Seal Elecl. Co., 250 Park Ave., New York, N. Y.
Hance-Parker Mfg. Co., Meriden, Conn.
Hankscraft Co., 615 E. Washington, Madison, Wis. (Oven Heater Unit.)
Hexwound. See Monitor Controller Co.
Industrial Heater Co., 300 Canal, New York, N. Y.
International Resistance Co., 2006 Chestnut, Philadelphia, Pa. (Radio Resistance.)
Kirschner's Mfg. Co., 255 Calyer, Brooklyn.
Louthan Mfg. Co., East Liverpool, O.
Marks, Elec. Co., Hiram, 304 Woodward Ave., Detroit, Mich.
Monitor Edgewound. See Clark Controller Co.
Monitor Controller Co., 51 S. Gay, Baltimore, Md.
National Elec'l Supply Co., 1328 New York Ave., Washington, D. C.
Nelco. See Nelson Electric Co.
Nelson Electric Co., Plant City, Fla.
Northern Electric Co., 2833 N. Western Ave., Chicago, Ill.
Ogden Mfg. Co., 3947 Armitage Ave., Chicago, Ill.
Ohmite Mfg. Co., 642 N. Albany Ave., Chicago, Ill.
Ohm-Spun. See States Co.
Op-al Elec. & Mfg. Co., 1057 W. 30th, Indianapolis, Ind.
Parker & Co., J. C., 407 Bulletin Bldg., Philadelphia, Pa.
Presto Products Co., 64 University Place, New York, N. Y.
Prometheus Elec. Corp., 358 W. 13th, New York, N. Y.
Pyrox. See Westinghouse Elec. & Mfg. Co.
Reben Elec. Mfg. Co., 2024 Gravesend Ave., Brooklyn, N. Y.
Remco. See Reben Elec. Mfg. Co.
Renuall. See Ogden Mfg. Co.
Repairall. See Waage Elec. Co.
Replaceall. See Waage Elec. Co.
Ribohm. See Ward Leonard Elec. Co.
Rodale Mfg. Co., 200 Hudson, New York, N. Y.
Security Elec. Mfg. Co., 2633 Canton St., Chicago, Ill.
Sepco. See Automatic Electric Heater Co.
Smith & Co., T. C., 3915 Powelton Ave., Philadelphia, Pa.
Smoothwound. See Monitor Controller Co.
Snoco. See Snow & Co.
Snow & Co., E. W., Rochester, N. Y.
Super. See Northern Elec. Co.
United Metal Art Mfg. Co., 293 Wyckoff Ave., Brooklyn, N.Y.
Vitrohm. See Ward Leonard Elec. Co.
Waage Elec. Co., 5100 W. Ravenswood Ave., Chicago.
Ward Leonard Elec. Co., Mt. Vernon, N. Y.

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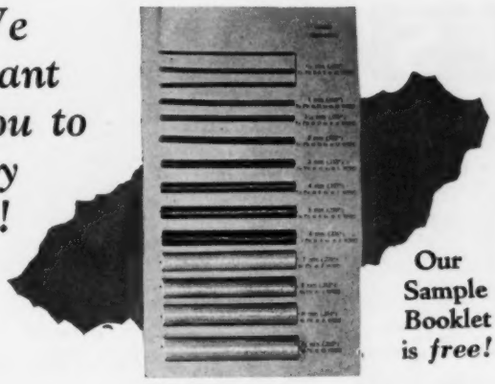

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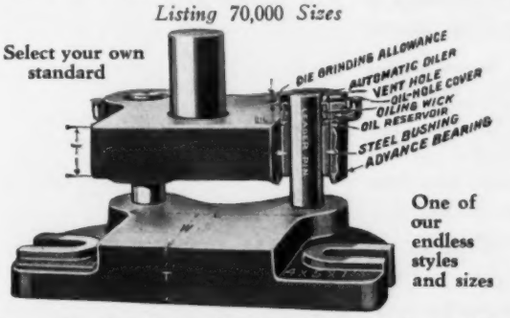

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Westinghouse Elec. & Mfg. Co., Mansfield, O.
Wiegand Co., Edwin L., 422 1st Ave., Pittsburgh, Pa.
Wirt Co., 5221 Greene, Philadelphia, Pa.

VACUUM CLEANER BAGS. See Bags, Vacuum Cleaner.

VACUUM DRYING & IMPREGNATING OVENS. See Ovens, Industrial.

VACUUM PUMPS. See Pumps, Vacuum.

VALVES, Electrically Operated

Absolute Con-tac-tor Corp., Elkhart, Ind.
Asco. See Automatic Switch Co.
Automatic Switch Co., 154 Grand, New York.
Chapman Valve Mfg. Co., Indian Orchard, Mass.
Coffin Valve Co., ft. of Tolman, Boston, Mass. (Water.)
Crane Co., S. Michigan Ave., Chicago, Ill.
Cutler-Hammer Mfg. Co., 1288 St. Paul Ave., Milwaukee.
Dual Automatic Valve Co., Rock Island, Ill.
Electric-Valve Mfg. Co., 68 Murray, New York, N. Y.
Fabrice Thermostatic Control Co., 4750 Sheridan Rd., Chicago, Ill.
Gas-Gard Co., 375 Main St., E., Rochester, N. Y. (Gas.)
General Electric Co., Schenectady, N. Y.
Golden-Anderson Valve Specialty Co., 1335 Fulton Bldg., Pittsburgh, Pa.
Jenkins. See Automatic Switch Co.
Liberty Electric Corp., Stamford, Conn.
Lunkenheimer Co., Cincinnati, O.
Minneapolis-Honeywell Regulator Co., Fourth Ave. & 28th, Minneapolis, Minn.
Northside Elec. Co., 4227 Spring Grove Ave., Cincinnati, O.
Protect-U. See Zisch Engineering Corp.
Reading Steel Casting Co., Bridgeport, Conn.
Savutime Devices, Inc., 88 Manhattan, Rochester, N. Y.
St. Louis Motor Valve Co., St. Louis, Mo.
Tagliabue Mfg. Co., C. J., 18-83rd St., Brooklyn, N. Y.
Teeple Co., L. R., 540 E. Ninth, Portland, Ore. (Gas.)
Victor. See Lunkenheimer Co.
Zisch Engineering Corp., 39 Avenue L, Newark, N. J. (Gas.)

VARNISH. See Paint, Varnish, Lacquer.
VARNISHED TAPE. See Tape, Varnished Fabric.
VARNISHED TUBING. See Tubing, Varnished Fabric.
VOLT BOXES. See Instruments, Laboratory Standard.
VOLTMETERS. See Instruments.

VULCANITE. See Rubber, Hard.

VULCANIZERS, WIRE INSULATION

American Insulating Machinery Co., 519 Huntington Ave., Philadelphia, Pa.
Biggs Boiler Works, Akron, Ohio.

WASHERS, FIBRE. See Fibre.

WASHERS, Leather

Michigan Leather Washer Co., 548 E. Fort, Detroit, Mich.

WASHERS, Lock

Keystone. See Positive Lock Washer Co.
Kickhaefer Mfg. Co., 359 Reade, Milwaukee, Wis.
National Lock Washer Co., Newark, N. J.
Positive Lock Washer Co., Ave. A & Miller, Newark, N. J.
Shakeproof Lockwasher Co., 2513 N. Keeler Ave., Chicago.
St. Louis Malleable Casting Co., 7701 N. Conduit Ave., St. Louis, Mo.

WASHERS, Metallic

Bridgeport Brass Co., 774 E. Main, Bridgeport, Conn.
Chase Brass & Copper Co., Waterbury, Conn.
Chicago Nut Mfg. Co., 2513 Cullerton, Chicago, Ill.
Hubbard Spring Co., M. D., Pontiac, Mich.
Massachusetts Machine Shop, Inc., Boston, Mass.
New England Screw Co., Dept. A., 44 Farnsworth, Boston.
Quadriga Mfg. Co., 213 W. Grand Ave., Chicago, Ill.
Wrought Washer Mfg. Co., 46 S. Bay, Milwaukee, Wis.

WATTMETERS. See Instruments.

WAX AND COMPOUNDS

Wax and Compound, Sealing and Filling.....See W
Junction Box, Potheads, Battery Tops, Bolt Head Holes.
Wax and Compound.....See S
Saturating and Finishing, Braided Wire, Impregnating Fabric and Paper.
Chatterton's Compound .....See C
Ajax. See Sherwin-Williams Co.
Asphalt Products Co., 6531 S. State, Chicago.. .. S ..
Bishop Wire & Cable Corp., 420 E. 25th, New York, N. Y. C
Biwax Corp., 208 S. La Salle, Chicago, Ill..... W .. ..
Black Negro. See Williams Co., F. M.
Bulls-Eye. See Zinsser & Co.
Candy & Co., 35th and Maplewood Ave., Chicago W S ..
Clifton Mfg. Co., 65 Brookside Ave., Boston.... C
Cochrane Chemical Co., 432 Danforth Ave., Jersey City, N. J. W S ..
Dielectric Mfg. Co., St. Louis, Mo. W .. C
Dolph Co., John C., 168 Emmet, Newark, N. J. W .. ..
Ever-Protect. See National Cable Compound Co.
Flake White. See Williams Co., F. M.
General Electric Co., Bridgeport, Conn. W .. ..
Globe Chemical Co., Murray Road & Big 4 R. R. St. Bernard, Cincinnati, O. W S ..
Goldo Brown. See Williams Co., F. M.
Great Lakes Thread & Yarn Co., 5133 Wesson Ave., Detroit, Mich. W .. ..
Hexsulate. See Tar Products Corp.
Imco. See Great Lakes Thread & Yarn Co.
India Red Seal. See Williams Co., F. M.
Insulatine Co., 1 Broadway, New York. W .. ..
Leverite. See Mitchell-Rand Mfg. Co.
Lime Seal. See Mitchell-Rand Mfg. Co.
McGill Mfg. Co., Valparaiso, Ind. C
Mineralac Elec. Co., 1045 Washington Blvd., Chicago, Ill. W .. ..
Mitchell-Rand Mfg. Co., 19 Vesey, New York.... W S C
Mule-Hide. See Lehon Co.
National Cable Compound Co., Mitchell, Ind.... W .. ..
Nu-Blac. See Star Porcelain Co.
Ohmlac Paint & Refining Co., 140 S. Dearborn, Chicago, Ill. W .. ..
Par Flexo. See Williams Co., F. M.
Rubberseal. See Mitchell-Rand Mfg. Co.
Rub-Flexo. See Williams Co., F. M.
Seidner & Enequist, Inc., 86 Hausman, Brooklyn, N. Y. W .. ..
Sherwin-Williams Co., Cleveland, O. W .. C
Standard Varnish Wks., 433 4th Av.. New York.. W .. ..
Standard Wax & Import Co., 110 E. 42nd, New York, N. Y. W S ..
Star Porcelain Co., Trenton, N. J. W .. C
Tacrite. See Seidner & Enequist, Inc.
Tar Products Corp., Providence, R. I.
Trotter & Co., E. T., 576 Johnson Ave., Brooklyn, N. Y. W S ..
Waverly Oil Wks., 54th and A. V. R. R., Pittsburgh, Pa. .. S ..
Williams Co., F. M., 1288 Prospect Ave., Brooklyn, N. Y.
Zinsser & Co., 48 Vesey, New York, N. Y..... W .. ..

WELDS, Lamp Lead-in. See Filaments, Incandescent

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A. E. F. See American Electric Fusion Corp.
Agnew Electric Welder Co., Milford, Mich.
Allan Mfg. & Welding Corp., 726 Washington, Buffalo.
Alternarc. See Electric Arc Cutting & Welding Co.
American Elec. Fusion Corp., 2610 Diversey Ave., Chicago.
Ames Co., 115 Ninth, Brooklyn, N. Y.
Atlas. See Railway Track Work Co.
Automatic Trolley Guard Co., 65 Carroll, Buffalo, N. Y.
Burke Electric Co., Erie, Pa.
Cushing Mfg. Co., 5617 Pacific Blvd., Los Angeles, Cal.
Dwyer Machine Co., Lynn, Mass.
Elsler Engineering Co., 756 S. 13th, Newark, N. J.
Electric Arc Cutting & Welding Co., 156 Jelliff Ave., Newark, N. J.
Electric Autolite Co., Toledo, O.
Electric Ry. Improvement Co., 2070 E. 61st, Cleveland, O
Electric Weldings Co. of America, 744 Court, Brooklyn, N. Y.
Electric Welding Machine Co., 1530 Larned, E., Detroit.
Erico. See Electric Railway Improvement.
Farwest Electric Welder Co., 1107 Northlake Ave., Seattle.
Federal Machine & Welder Co., Dana Ave., Warren, O.
Fusion Welding Corp., 103rd St. & Torrence Ave., Chicago.
Fuzon. See Fusion Welding Corp.
General Electric Co., Schenectady, N. Y.
General Engrg. & Supply Co., 160 5th Ave., New York, N. Y.
Gesco. See General Engineering.
Gibb Welding Machines Co., Bay City, Mich.
Hansen. See Northwestern Mfg. Co.
Indianapolis Switch & Frog Co., Springfield, O.
Lincoln Electric Co., Coit Rd. and Kirby Ave., Cleveland.
McAdams Co., J. C., 912 Second Ave., Long Island City.
Northwestern Mfg. Co., 480 Clinton, Milwaukee, Wis.
Plastic Arc. See Wilson Welder & Metal Co.
Pyrotip. See General Elec. Co.
Railway Track Work Co., 3132 E. Thompson, Philadelphia.
Rail Welding & Bonding Co., 1615 Collamer Ave., Cleveland.
Ryerson & Son, Jos. T., 2558 W. 16th, Chicago, Ill.
Seneca Electric Welder Corp., 5057 Woodward, Detroit, Mich.
Siemund Wenzel Electric Welding Co., 79 Hancock, Long Island City, N. Y.
Swift Elec. Welder Co., 2567 W. Grand Blvd., Detroit,
Taylor-Winfield Corp., 12 Atlantic, Warren, O.
Thompson Electric Welding Co., Lynn, Mass.
Toledo. See Thompson.
U. S. L. Battery Corp., Niagara Falls, N. Y.
Welding Materials Co., 114 Liberty, New York, N. Y.
Weldrite. See Electric Welding Machine Co.
Wemco. See Welding Materials Co.
Westinghouse Elec. & Mfg. Co., East Pittsburgh, Pa.
Wilson Welder & Metal Co., Hoboken factory, Terminal Bldg., Hoboken, N. J.
Winfield Elec. Welding Machine Co., 12 Atlantic, Warren, O.
Zeus. See Gibb Welding Machine Co.

WHEATSTONE BRIDGES. See Instruments, Laboratory Standard.

WINDERS

Armature & Field Coil. See Winding Machines, Armature & Field Coil.
Coil. See Winding Machines, Armature & Field Coil.
Electromagnet. See Winding Machines, Induction Coil.
Filament. See Machines, Lamp Making.
Induction Coil. See Winding Machines, Induction Coil.
Loom. See Winding Machines, Armature & Field Coil.
Winding Forms. See Forms, Coil Winding.

WINDING FORMS. See Forms, Coil Winding.

WINDING MACHINES, Armature and Field Coil

Armature Coil Equipment Co., 2415 Forestdale Ave., Cleveland, Ohio.
Browning. See Mutual Foundry & Machine Co.
Chapman Electric Works, P. E., 1820 Chouteau Ave., St. Louis, Mo.
Columbia Machine Works & Malleable Iron Co., Atlantic Ave. & Chestnut St., Brooklyn, N. Y.
Comstock Mfg. Co., Wilkes-Barre, Pa.
Electric Service Supplies Co., 17th & Cambria Sts., Philadelphia, Pa.
Fredericks Co., H. M., Lock Haven, Pa.
Handy. See Armature Coil Equipment Co., 2415 Forestdale Ave., Cleveland, Ohio.
Hunsdorf, Wm., 2056 E. Fourth, Cleveland, O.
Liberty Starter Co., W. Fort & Minnie Sts., Detroit, Mich.
Lipe, W. C., 208 S. Geddes, Syracuse, N. Y.
Lyknu. See Fredericks Co.
Munsdorf Company, W. P., 720 Frankfort, Cleveland, Ohio.
Mutual Foundry & Machine Co., Atlanta, Ga.
Onan, David W., 43 Royalstone Ave., Minneapolis, Minn.
Peerless. See Electric Service Supplies Co.
Segur. See Electric Service Supplies Co.
Superior. See Armature Coil Equipment Co.

WINDING MACHINES, Induction Coil

Belden Mfg. Co., 2310B S. Western Ave., Chicago, Ill.
Dudlo Mfg. Co., Div. of General Cable Corp., Fort Wayne, Ind.
Easton Coil Co., Easton, Pa.
Electrical Products Mfg. Co., Providence, R. I.
Eureka Tool & Machine Co., 42 Walnut, Newark, N. J.
Leesona. See Universal Winding Co.
Lipe, W. C., 208 S. Geddes, Syracuse, N. Y.
Morris Register Co., 29th & Broadway, Council Bluffs, Iowa.
Radio Production Machinery Co., 212 Centre, New York.
Sidlon Company, Frank, 253 A St., Boston, Mass.
Universal Winding Co., Boston, Mass.
Weber & Scher Mfg. Co., 263 Sussex Ave., Newark, N. J.
Weehawken Elec. & Mfg. Co., 543 Gregory Ave., Weehawken, N. J.

WINDINGS. See Coils, Finished.

WINDOW SHADES, Factory

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WIRE (Cable) (Cord), Aluminum. See Aluminum.
Copper Clad. See Wire, Copper Clad.
Forms. See Forms, Wire.
Frames. See Forms, Wire.
Fuse. See Fuses and Fuse Wire.
Molybdenum. See Molybdenum.

Phosphor Bronze. See Phosphor Bronze.
Platinum. See Platinum.
Radio Bus. See Wire, Bare.
Scrapers. See Scrapers, Wire.
Strippers. See Scrapers, Wire;
Tungsten. See Filament, Incandescent Lamp.

WIRE, Bare

Armature Banding .....See S
Copper Wire .....See C
Iron Wire .....See S
Phosphor Bronze .....See B
Radio Bus Wire .....See C
Resistance Wire .....See R
Steel Wire .....See S

Advance. See Driver Harris Wire Co.
Alloy Metal Wire Co., Moore, Pa..... C R ..
American Brass Co., 25 Broadway, New York,
American Copper Products Corp., 233 Broadway, New York, N. Y. ..... C R ..
American Electrical Works (Phillipsdale), Providence, R. I. ..... C .. ..
American Insulated Wire & Cable Co. Div. of General Cable Corp., 954 W. 21st, Chicago.... C .. ..
American Steel & Wire Co., 208 S. La Salle, Chicago, Ill. ..... C .. ..
Anaconda. See American Brass Co.
Anylite Elec. Co., Fort Wayne, Ind..... C .. ..
Ballast. See Gilby Wire Co.
Baltimore Copper Mills (Div. of General Cable Corp.), Baltimore, Md..... C .. ..
Bassett Metal Goods Co., Derby, Conn. (General Sales Agent, Hatheway & Co., 16 Hudson, New York, N. Y. ..... C .. ..
Belden Mfg. Co., 2310B S. Western Ave., Chicago C .. ..
Beldenite. See Belden Mfg. Co.
Bradford, Kyle & Co., Plymouth, Mass..... .. R ..
Braidite. See Cornish Wire Co.
Brenvar. See American Insulated Wire & Cable Co.
Bridgeport Brass Co., Bridgeport, Conn..... C .. ..
Calido. See Driver Harris Wire Co.
Chromel. See Hoskins Mfg. Co.
Chromic. See Murray-Harris Wire Co.
Climax. See Driver Harris Wire Co.
Comet. See Driver Harris Wire Co.
Comin. See Gilby Wire Co.
Cook Plate Co., Edw. N., 70 Ship, Providence, R. I. C .. ..
Copel. See Hoskins Mfg. Co.
Copperweld Steel Co., Glassport, Pa..... C .. ..
Cornish Wire Co., 30 Church, New York, N. Y.. C .. ..
Corwico. See Cornish Wire Co.
Crapo. See Indiana Steel & Wire Co.
Crescent Ins. Wire & Cable Co., Trenton, N. J.. C .. ..
Cupron. See Gilby Wire Co.
Darow Mfg. Co., 97 Greene, New York, N. Y... C .. ..
Detroit Insulated Wire Co., Detroit, Mich..... C .. ..
1885. See Chicago Insulated Wire & Mfg. Co.
Driver Harris Wire Co., Harrison, N. J..... .. R ..
Electron. See Bassett Metal Goods Co.
Excelicier. See Branford Elec. Co.
Fullman Mfg. Co., 1209 Jefferson, Latrobe, Pa.. .. .. ..
Gilby Wire Co., Riverside Ave., Newark, N. J.... .. R ..
Goldmark Co., James, 83 Warren, New York.. C .. ..
Hope Webbing Co., Providence, R. I. (Braided Wire Tape) ..... C .. ..
Hoskins Mfg. Co., Detroit, Mich..... .. R ..
Hudson Wire Co., Ossining, N. Y..... C R ..
Ideal. See Driver Harris Wire Co.
Indiana Rubber & Insulated Wire Co., Jonesboro, Ind. ..... C .. ..
Indiana Steel & Wire Co., Muncie, Ind. ....
Inland Wire & Cable Co., Sycamore, Ill..... C .. ..
Karma. See Driver Harris Wire Co.
Keystone. See Fullman Mfg. Co.
Lucero. See Driver Harris Wire Co.
Marion Insulated Wire & Rubber Co., Marion, Ind. C .. ..
Monarch Elec. & Wire Co., 622 W. Adams, Chicago C .. ..
Monex. See Standard Alloy Wire Co.
National-Harris Wire Co., 113 Orchard, Newark.. .. R ..
Nehring Electrical Works, De Kalb, Ill. ..... C .. ..
Nichrome. See Driver Harris Wire Co.
Novar. See Standard Alloy Wire Co.
Page Steel & Wire Co., Bridgeport, Conn..... .. ..
Paranite. See Indiana Rubber & Insulated Wire Co.
Peerless. See Alloy Metal Wire Co.
Phillips Wire Co., Pawtucket, R. I. ..... C .. ..
Phono-Electric. See Bridgeport Brass Co.
Premier. See Alloy Metal Wire Co.
Providence Insulated Wire Co., Providence, R. I.. C .. ..
Race. See Ross Wire Co.
Roebling's Sons Co., John A., Trenton, N. J..... C .. ..
Rome Wire Co., Div. of General Cable Co., Rome, N. Y. ..... C .. ..
Rosa Wire Co., 69 Bath, Providence, R. I..... C .. ..
Silcrimp. See Valley Narrow Fabric Co.
Seneca Wire & Mfg. Co., Fostoria, O. ....
Stichrome. See Alloy Metal Wire Co.
Solar. See Gilby Wire Co.
Sparg Wire Co., J. A., Rome, N. Y..... C .. ..
Standard Alloy Wire Co., Elizabeth, N. J. .... R ..
Standard Underground Cable Co. (Div. of General Cable Corp.), Pittsburgh, Pa. ..... C .. ..
Super-Insulated Wire Co., Plymouth, Mass. ..... C .. ..
Superior. See Alloy Metal Wire Co.
Talking Tape. See Hope Webbing Co.
Therlo. See Driver Harris Wire Co.
Tophet. See Gilby Wire Co.
Tru-Lay. See Page Steel & Wire Co.
Valley Narrow Fabric Co., Falls, R. I.
Wheeler Insulated Wire Co., Bridgeport, Conn.. C .. ..

WIRE, Copper Clad

American Steel & Wire Co., 208 S. La Salle, Chicago, Ill.
Copperweld Steel Co., Rankin, Pa.
Standard Underground Cable Co., Pittsburgh, Pa.

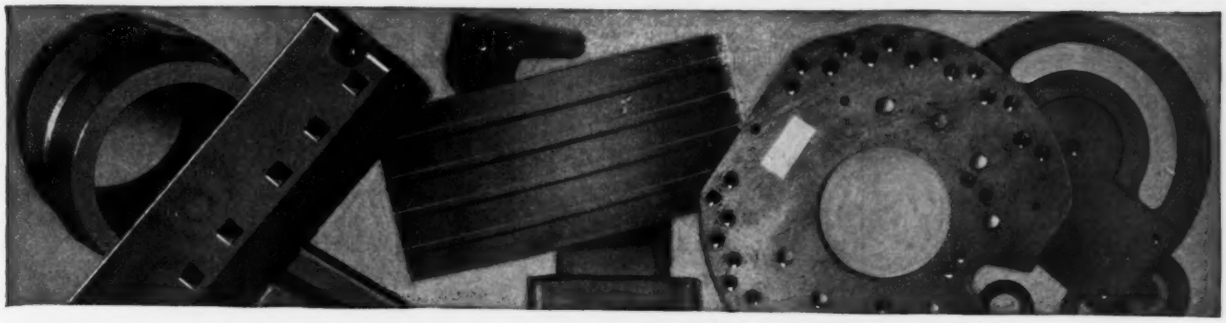
WIRE SOLDER. See Solder, Bar and Wire.

WIRE DRAWING MACHINES

Drawing and Re-drawing Mill Equipment for Small Wires.
American Insulating Machinery Co., 519 Huntington Ave., Philadelphia, Pa.
Sleeper-Hartley, Inc., Worcester, Mass.
Torrington Manufacturing Co., 70 Franklin, Torrington, Conn.
Vaughn Machinery Co., Cuyahoga Falls, Ohio.
Wire Machinery Corp. of Am., New Haven, Conn.

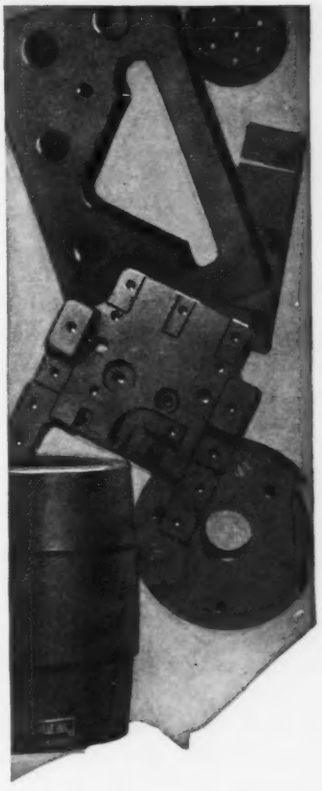
WIRE, Insulated

	KEY
Annunciator, Office, Bell Wire	See A
Asbestos Covered Heater Cord	See H
Asbestos Covered Magnet Wire	See M
Enameled Magnet Wire	See M
Fixture Wire	See R
Flexible Reinforced Heavy Duty Cord	See F
Heater Cord	See H
Ignition Cable	See R
Lamp Cord	See R
Magnet Wire	See M
Rubber Covered Wire & Cable	See R
Stove Wire	See H
Telephone Cord	See T



For Moulded Shapes

SPECIFY ASBESTOS EBONY



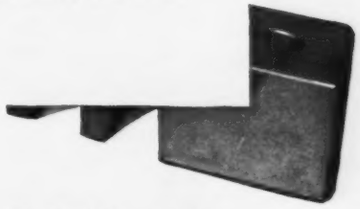
BY using Johns-Manville moulded Asbestos Ebony for electrical devices requiring such material you make certain of the three chief requisites for all such special shapes.

First, the material has a very high dielectric resistance, always a desirable quality.

Second, Asbestos Ebony in moulded form has the same structural strength which has become famous in power stations all over the country. This strength is due to the fact that Johns-Manville makes Asbestos Ebony by combining asbestos fibres and Portland Cement under heavy pressure into a rigid, monolithic material, free from laminations.

Lastly, but often exceedingly important, Asbestos Ebony is impervious to water or moisture, and will not absorb dampness from the atmosphere, even when exposed to sea air.

For all work requiring special forms Asbestos Ebony is the safest material. We are always glad to estimate or make suggestions regarding the use and cost of moulded Asbestos Ebony. *Address Electrical Section, Johns-Manville Corporation, at New York, Chicago, Cleveland, San Francisco or Toronto.*



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Johns-Manville

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IT costs you nothing but postage to send us models or blue prints of parts you have under development—or samples of parts which are giving you trouble. And, most likely, our engineers can save you money.

Cetec parts are molded to form, and incorporate metal inserts where necessary. No machining, drilling or fitting is required. Your assembly is easier, quicker and cheaper—because each Cetec molded part is an exact duplicate of every other.

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MOLDED PRODUCTS CORPORATION
MERIDEN, CONN.

WIRE, Insulated—Continued

A-A Wire Co. (Div. of General Cable Corp), 420 Lexington Ave., N. Y. C.. R
A-1 Brand. See American Insulated.
Acme Wire Co., New Haven, Conn. Enamaled Silk, Cotton ..... M
Amelectric. See American Elec.
American Brand. See American Insulated Wire & Cable Co.
American Brass Co., 25 Broadway, New York, N. Y. ..... A .. M ..
American Copper Products Corp., 233 Broadway, New York, N. Y. .....
American Electrical Works (Philipsdale), Providence, R. I. ..... M
American Enameled Magnet Wire Co., Muskegon, Mich. ..... M
American Insulated Wire & Cable Co. Div. of General Cable Co., 954 W. 21st, Chicago, Ill. ..... M
American Insulated Wire Corp., Div. of General Cable Co., 45 Baker, Providence, R. I. ..... R F .. A T ..
American Steel & Wire Co., 208 S. La Salle, Chicago, Ill. ..... R F H A T M
Americore. See American Steel.
Amerite. See American Steel.
Amerixe. See American Steel.
Amparak. See American Steel.
Anaconda. See American Brass Co.
Ansonia Electrical Co., Ansonia, Conn. Silk, Cotton, Enameled..... A .. M
Armoriokt. See American Steel.
Bay State Insulated Wire & Cable Co., Paydras (Mattapan), 26, Boston..... R .....
Belden Mfg. Co., 2310B S. Western Ave., Chicago, Ill. ..... R F H A T M
Beldenamel. See Belden Mfg. Co.
Beldenite. See Belden Mfg. Co.
Bishop Wire & Cable Corp., 420 E. 25th, New York, N. Y. ..... R F .....
Boston Insulated Wire & Cable Co., 65 Bay, Boston, Mass. ..... R F H .....
Bradford, Kyle & Co., Plymouth, Mass. ..... M
Cablex. See Collyer Insulated Wire Co.
Celatsite. See Acme Wire Co.
Collyer Insulated Wire Co., Pawtucket, R. I. ..... R F H .....
Colorbeston. See General Elec. Co.
Condex. See Simplex Wire Co.
Colorubber. See Belden Mfg. Co.
Copperweld Steel Co., Rankin, Pa..... R .....
Cotenamel. See Belden Mfg. Co.
Cottonite. See Acme Wire Co.
Crescent Ins. Wire & Cable Co., Trenton, N. J. ..... R F H A T M
Darow Mfg. Co., 97 Greene, New York, N. Y. ..... R .....
Davis-Jones Insulated Wire Co., Pawtucket, R. I. ..... R F H A T ..
Deltabeston. See York Insulated.
Detroit Insulated Wire Co., Detroit, Mich. R ..... T ..
Diamond Braiding Mills, Chicago Heights R F H .....
Dreadnaught. See Indiana Rubber Co.
Driver-Harris Co., Harrison, N. J..... R .. H .....
Dudlo Mfg. Co., Div. of General Cable Corp., Fort Wayne, Ind.. ..... M
Durabilt. See Tubular Woven.
Duracord See Tubular Woven.
Durawire. See Tubular Woven.
Duro. See McEvoy, C. H.
Eagle. See Goldmark Co., James.
Eastern Insulated Wire Co., Tilton, N. H. R .....
1885. See Chicago Insulated Wire.
Enamelite. See Acme Wire Co.
Fibrex. See Simplex Wire Co.
Flexible Woven Cable Co., 755 Boylston, Boston, Mass. ..... F .....
Flex-O-Cord. See Packard Elec. Co.
Garco. See General Asbestos Co.
Gavitt Mfg. Co., West Brookfield, Mass. ..... T ..
General Asbestos & Rubber Co., Charleston, S. C. ..... H .....
General Elec. Co., Bridgeport, Conn.... R F H .... M
Giant. See Collyer Insulated Wire.
Goldmark Co., James, 83 Warren, New York, Annunciator and Asbestos, Cotton, Silk and Enameled Magnet ..... A .. M
Goodyear Rubber Insulating. See Graybar Electric Co.
Graybar Elec. Co., Graybar Bldg., Lexington Ave. & 43rd St., New York, N. Y. R ..... T ..
Grimshaw. See New York Ins.
Habirshaw Cable & Wire Corp., 10 E. 43rd, New York, N. Y. ..... R .....
Hatfield Rubber Wks., Inc., Hillside, N. J. R .. H .....
Hazard Insulated Wire Works, Div. of Okonite Co., Wilkes-Barre, Pa.... R F .. A ..
Holyoke Co., 621 Broadway, New York.. R ... A .. M
Indiana Rubber & Insulated Wire Co., Jonesboro, Ind. ..... R F H .....
I. X. L. See Collyer Insulated.
Kable. See Safety Cable Co.
Kenrite. See American Insulated.
Kerite Ins. Wire Cable Co., 30 Church, New York, N. Y. ..... R ..... T M
Kilo. Co., 2 E. 23d, New York..... T M
Koelle, Frederick C., Real Estate Trust Bldg., Philadelphia, Pa. ..... T ..
Liberty. See Nat. Metal Molding.
Lowell Insulated Wire Co., Lowell, Mass. R F H .....
Loxsteel. See Hazard Insulated Wire Works.
McEvoy, C. H., Lowell, Mass..... R ..... T ..
Maring Wire Co., Muskegon, Mich. Cotton, Silk, Enameled ..... M
Marion Insulated Wire & Rubber Co., Marion, Ind. ..... R F H A T ..
Massachusetts Elec. Mfg. Co., West Lynn, Mass. ..... M
Monarch Elec. & Wire Co., 622 W. Adams, Chicago, Ill. ..... A .....
Montgomery Co., J. R., Windsor Locks, Conn. ..... T ..
National India Rubber. See U. S.
National Elec. Products Corp., 1110 Fulton Bldg., Pittsburgh, Pa..... R F H A T M
N. E. See Goldmark Co., James.
New England Wire Co., Westfield, Mass.. R .. H .. T ..
New York Insulated Wire Co., 114 Liberty, New York, N. Y. ..... R .....
Nitro. See Belden Mfg. Co.
O. K. See Phillips Wire Co.
Okonite Co., Passaic, N. J..... R .....
Ozex. See Simplex Insulated Wire
Packard Electric Co., Warren, O..... R F .....
Parac. See Phillips Wire Co.
Paracore. See U. S. Rubber Co.
Paraflex. See Bishop Wire & Cable.
Paranite. See Indiana Rubber.
Parkerite. See Seward Wire Co.
Peco. See Packard Elec. Co.

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"CUPRON"
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Philadelphia Insulated Wire Co., 200 N. Third, Philadelphia, Pa..... H A T ..
Phillips Wire Co., Pawtucket, R. I..... R .....
Providence Insulated Wire Co., Providence, R. I. ..... R F H A .....
Raven Core. See New York.
Reliance. See American Steel.
Rockbestos Products Corp., Nicoll & Conner Sts., New Haven, Conn..... R .. H .. T M
Roebling's Sons Co., John A., Trenton, N. J. ..... R F H A T M
Rome Electrical Co., Rome, N. Y. ..... M
Rome Wire Co., Rome, N. Y..... R F H .. T M
Ross Wire Co., 69 Bath, Providence, R. I.. R .....
Runzel-Lenz Elec. Mfg. Co., 1751 N. Western Ave., Chicago, Ill..... T ..
Safety Cable Co. (Div. of General Cable Corp.), New York ..... R F H .....
Salamander. See York Insulated.
Seward Wire Co., Parkersburg, W. Va. R .....
Silkenamel. See Belden Mfg. Co.
Silkenite. See Acme Wire Co.
Simcore. See Simplex Wire.
Simplex Wire & Cable Co., 63 Sydney, Cambridge, Mass. ..... R F .....
Shield. See Ansonia Elec'l Co.
Spiralweave. See Hazard Ins. Wire
Standard Alloy Wire Co., Elizabeth, N. J. .... H .....
Standard Insulated Wire Co., Westfield, Mass. ..... R .. H .....
Standard Underground Cable Co., Pittsburgh, Pa. (Div. of General Cable.) R F H A T ..
Sterling. See Standard Underground.
Sterling Insulated Wire Co., Fall River, Mass. ..... R .....
Strand & Sweet Mfg. Co., Winsted, Conn. ..... M
Super-Insulated Wire Co., Plymouth, Mass. ..... M
Super-Service. See Rome Wire Co.
Sweetstrand. See Strand & Sweet.
Tip-Top. See Standard Underground.
Tirex. See Simplex Wire & Cable.
Trenchlay. See Rome Wire Co.
Triangle Conduit Co., Dry Harbor Rd. & Cooper Ave., Brooklyn..... R .....
Tubular Woven Fabric Co., Pawtucket, R. I. ..... R F .....
United States Rubber Co., 1790 Broadway, New York, N. Y. ..... R .. H A T ..
U. S. Royal. See United States.
Varflex Corp., Rome, N. Y. ..... M
Warrior. See American Copper.
Wheeler Insulated Wire Co., Bridgeport, Conn. ..... R F H A T M
White, J. M., 1128 Oliver, Philadelphia, Pa. ..... R F H .. T ..
Whitney Blake Co. See Graybar Electric Co.
Wovenite. See Flexible Woven.
York Insulated Wire Wks. of G. E. Co., 120 Broadway, New York, N. Y..... R .. H .... M

WIRE, Steel Flat
Steel Coating for Armored Conductor.
American Steel & Wire Co., 208 S. La Salle, Chicago, Ill.
Crescent Insulated Wire & Cable Co., 319 N. Oden Ave., Trenton, N. J.
Roebling's Sons Co., John A., Trenton, N. J.
Seneca Wire & Mfg. Co., Fostoria, O.

WIRE MANUFACTURING MACHINES

(See Also Wire Drawing Machines; Insulation Mixers; Taping Machines, Wire; Wire Polishing Machines; Enameling Machines for Magnet Wire; Wire Wrapping Machines; Vulcanizers, Wire Insulation.)

Armoring Machines ..... See A
Braiding Machines ..... See B
Bunching Machines ..... See S
Covering Machines ..... See I
Insulating Machines ..... See I
Insulation Straining Machines..... See I
Measuring Machines ..... See M
Park Cabling Machines..... See A
Saturating Tanks ..... See F
Spooling Machines ..... See U
Stranding Machines ..... See S
Tinning Tanks ..... See F
Winding Reels ..... See U

Adamson Machine Co., Akron, Ohio.. I A .....
Aimco-Seward. See American Insulating Machinery Co.
American Insulating Machinery Co., 519 Huntington Ave., Philadelphia, Pa. I A .... S U F
Breguet. See American Insulating Machy.
Crescent. See Royle & Sons, John.
Durant Mfg. Co., 662 Buffum, Milwaukee, Wis. ..... M .. U ..
Housatonic Machine & Tool Co., Bridgeport, Conn. ..... I ..... U ..
Minneapolis Elec. & Construction Co., 80 S. 12th St., Minneapolis, Minn. ..... M .. U ..
Nebutteo. See New England Butt Co.
New England Butt Co., 324 Pearl, Providence, R. I. ..... I A B M S U ..
Peerless. See Royle & Sons, John.
Royle & Sons, John, Paterson, N. J. I .....
Sleeper & Hartley, Inc., Worcester, Mass. ..... A .... S U
Terkelson Machine Co., 326 A St., Boston, Mass. ..... M .....
Textile Machine Works, Reading, Pa. .... B .....
Universal Wire Machy. Co., 69 Daggett, New Haven, Conn..... .. A ..... U F
Utility Mfg. Co., Cudahy, Wis..... I .....
Wardwell Braiding Machine Co., Central Falls, R. I..... B .....
Watson Mfg Co., Paterson, N. J.. I A .. M S .. F

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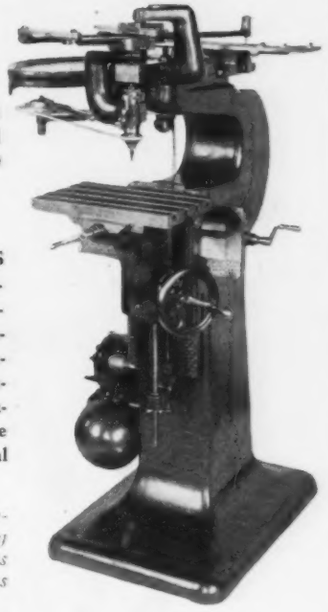

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TRY US
and you will know why we are always busy on springs and screw machine parts. Quality and service our WATCHWORDS.
The Peck Spring Co.
Plainville, Conn.

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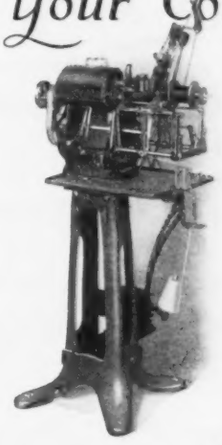

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Purchase these same coils from us, carefully wound to your specifications and ready for application to your product

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Lesson
BOSTON

Wire Manufacturing Machines—Continued
Wire Machinery Corp. of Am., New Haven, Conn. ..... M S U ..
Weir. See Housatonic Machine
WIRE POLISHING MACHINES
(See Also Wire Manufacturing Machines).
American Insulating Machinery Co., 519 Huntington Ave., Philadelphia, Pa.
New England Butt Co., 324 Pearl, Providence, R. I.
WIRE STRAIGHTENING MACHINES
Kane & Roach, Syracuse, N. Y.
Shuster Co., F. B., New Haven, Conn.
WIRE TAPING MACHINES. See Taping Machines, Wire.
WIRE VULCANIZING MACHINES. See Vulcanizers Wire Insulation.
WIRE WRAPPING MACHINES
Terzelson Machine Co., 326 A St., Boston, Mass.
WOOD BLOCKS. See Cabinets & Boxes, Wood.
Boxes. See Cabinets & Boxes, Wood
Cabinets. See Cabinets & Boxes, Wood
Pulleys. See Pulleys, Composition.
Woods Metal. See Radio Mountings.
WRAPPERS, Paper. See Boxes and Wrappers.
WRAPPERS, Tungsten Lamp. See Boxes and Wrappers.
WRAPPING MACHINES, WIRE. See Wire Wrapping Machines.

YARN AND THREAD; Silk, Cotton, Asbestos
American Asbestos Co., Norristown, Pa.
Asbestos Fibre Spinning Co., North Wales, Pa.
Florsheim, H. A., 225 Fifth Ave., New York, N. Y.
General Electric Co., Schenectady, N. Y.
Great Lakes Yarn & Thread Co., 5133 Wesson Ave., Detroit, Mich.
Johns-Manville Corp. (Elec'l Dept.), New York, N. Y. (Asbestos.)
Multiple Winding Co., 77 Summer, Boston, Mass.
Rich & Co., H. S., 180 S. Water, Providence, R. I.
Ryle & Co., Wm., 381 Fourth Ave., New York, N. Y.
Silkslip. See Worcester Bleach & Dye Wks. Co.
Smith & Dove Mfg. Co., Andover, Mass. (Linen Thread.)
Worcester Bleach & Dye Wks., Worcester, Mass.

ZINC
New Jersey Zinc Co., 160 Front, New York, N. Y.
Platt Bros. & Co., Waterbury, Conn. (Strips.)

ZINCS AND COPPERS, Battery
Bunnell & Co., J. H., 32 Park Pl., New York, N. Y.
Edes Mfg. Co., Plymouth, Mass.
Extruded Metal Corp., 184 53rd, Brooklyn, N.Y. (Zinc Cups.)
Franklin. See Grasselli Chemical Co.
Grasselli Chemical Co., Guardian Bldg., Cleveland, O.
Horse Head. See New Jersey Zinc Co.
Illinois Zinc Co., Peru, Ill.
Lind Mfg. Co., 70 Wyckoff Ave., Brooklyn, N.Y. (Zinc Cups.)
Mattiessen & Hegeles Zinc Co., La Salle, Ill.
New Jersey Zinc Co., 160 Front, New York, N. Y.

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ELECTRICAL RECORD has been the market place for those buyers in the electrical industry who are interested in electrical devices, materials and accessories which they buy to install or for resale—the men whom every manufacturer must influence before his products are stocked, moved or consumed.

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...a powerful sales factor in 1928

Stewart Die Casting service produces many definite advantages in the manufacture of hundreds of different types of product, each advantage contributing to the major feature of overall economy. Production economies include:

Reduced unit costs

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Complete interchangeability and simpler, faster assembly

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Release of working capital

Elimination of manufacturing "grief"

Improvements in finished products are:

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Fewer adjustments and less "free service" required

Improved performance as a result of detail improvements possible with the Stewart Die Casting process.

Stewart engineers are specialists in die design and in the adaptation of products to production as die castings. Their services are available to manufacturers without charge. The Stewart plant is the largest in the world devoted exclusively to die casting. Automatic machinery, principally of Stewart design, and an organization highly trained in the Stewart process insures economy, accuracy, and unrivalled standards of service.

PARTS or entire sub-assemblies die cast by Stewart process give greatly improved appearance to the products of many manufacturers now using Stewart service.

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The Stewart process of die casting delivers these advantages for many manufacturers now. Definite information on the advantages of Stewart Die Castings as applied to your production will be furnished on receipt of blueprints. Send them today.

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Detroit Pittsburgh Milwaukee St. Louis
Dayton New York City Cleveland

Stewart

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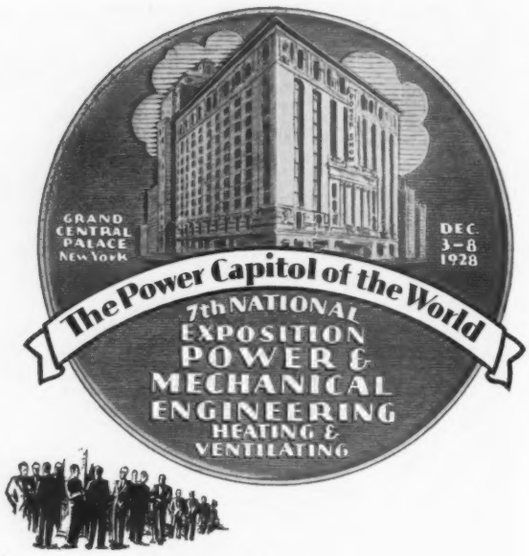
GRAND CENTRAL PALACE New York
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7th NATIONAL EXPOSITION POWER & MECHANICAL ENGINEERING HEATING & VENTILATING

Millions will be spent

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Engineers and employers of engineering services must have definite, exact information. Without this they cannot properly advise on the purchase of the materials and machinery for which they are responsible.

That is why every year important plant changes wait until this great Exposition opens its doors. Here the men who control the bulk of the world's expenditure for power equipment and accessories get exact, precise information. Here they see and discuss with specialists principles and details otherwise hard to get. Here they see what's best for them—and millions are spent as a result.

Come here yourself for definite, precise information on all that's best for generating, transmitting, measuring, controlling and using power.

Note the dates: December 3 to 8, Grand Central Palace, New York.

Thursday, December 6, will be Export Day. Exhibitors will have representatives of their export departments in attendance especially to meet foreign visitors.

Management International Exposition Company, Largest Industrial Exposition Organization in the World 2903

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We have manufactured and supplied glassine paper for insulating to the Electrical Trade for 25 years.

Made in various thicknesses
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Sheets and perfect rolls
½" wide and up
± 1/64"

On contract orders will carry your paper in stock so that we can make immediate shipment when required.

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Chicago, Ill.

Try this on your washing machine

Instead of the old tune of "START—STOP—RACK—WRENCH," try the ONEIDA Flexible Coupling on your washing machine. This simple little device absorbs the shock of sudden starting and stopping and adds years to the motor's natural life. It should be standard equipment on all washing machines; and it is also a life-saver for oil-burners, ironers, refrigerators, etc. We would like to tell you more about it.

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ONEIDA
FLEXIBLE COUPLING

for *every* direct-connected appliance

PRECISION

To the essential ingredients for moldings it is what discipline is to an army

IN International molding service, precision stands always as the element accorded the highest importance. To you as a customer this means the greatest certainty of satisfaction.

¶ Precision in estimating prevents misunderstanding as to work accepted. Precision in making your molds means right-fitting moldings when you get them. Precision in producing your metal inserts provides for their being right, too —rigidly held to your tolerances. Likewise, precision in assembling the inserts as a part of the molding operation, precision in mixing the molding ingredients, precision in the molding.

¶ In every stage of International molding service, hard and fast precision insures the most exact attention to every detail.

¶ May we figure on your next molding job ?

PRECISION MOLDERS OF BAKELITE AND SHELLAC COMPOSITION

INTERNATIONAL INSULATING CORPORATION

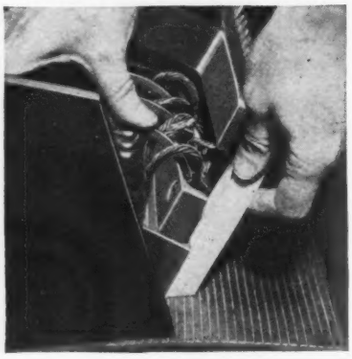
Division of The General Industries Co.

ESTABLISHED 1875 ELYRIA, OHIO

Labor is costly—

Save it with

DIAMOND-D BRUSH SEATERS



Put a true seat on any brush in less than a minute !

Just hold a Brush Seater at the heel of any brush, with the machine running, so that the revolving commutator or ring carries some of the Brush Seater material under the brush. In less than a minute, without manual effort, you have a perfectly seated brush with complete contact over its entire face. And you have saved more than 75% of the time ordinarily required.

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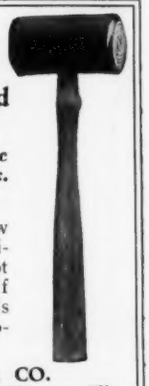

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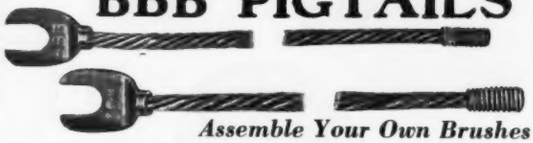

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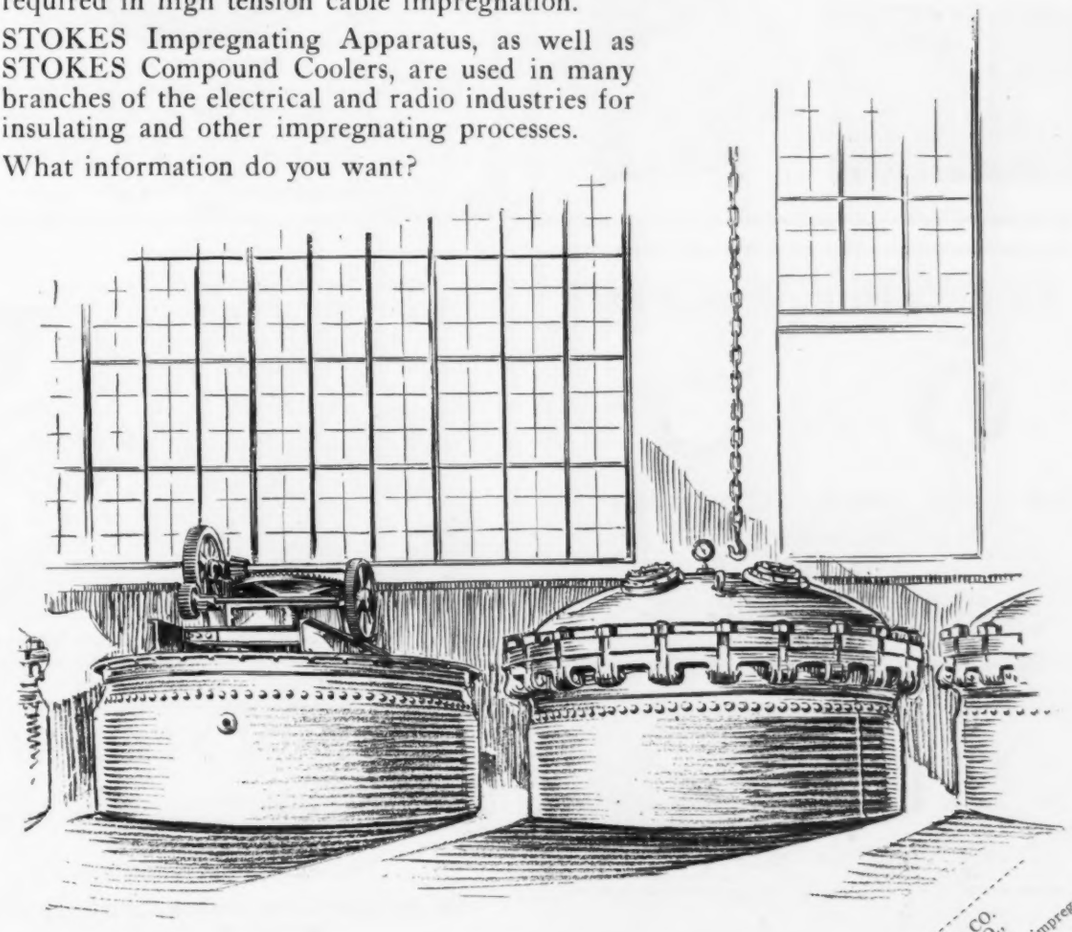

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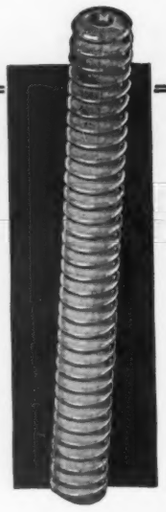

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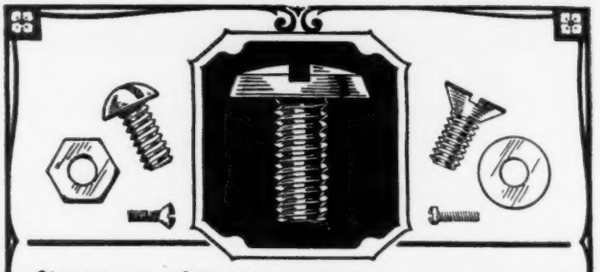

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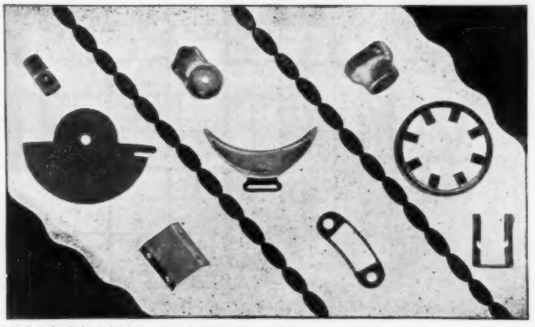

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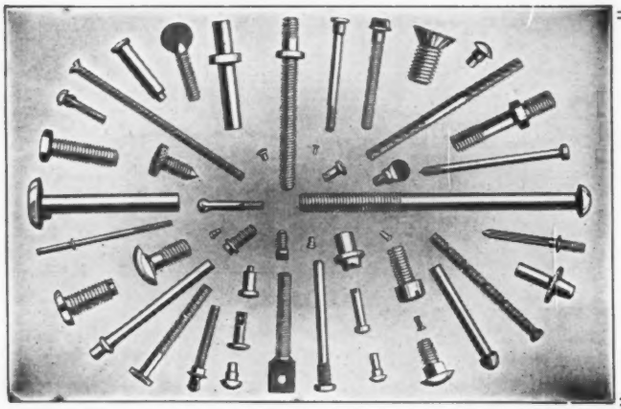

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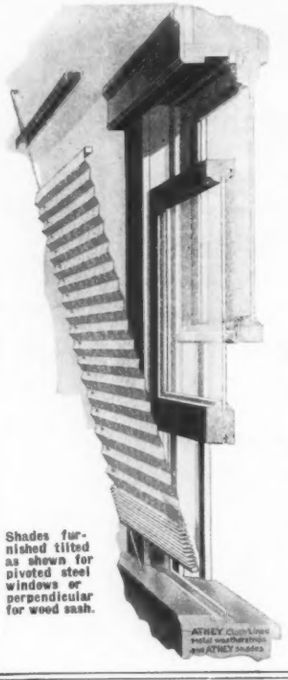
to sit in a cold, drafty room where you would not wish to work yourself?



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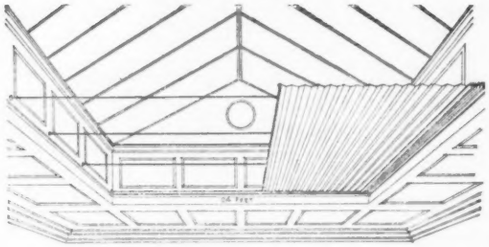

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U S. Patent June 13, 1922 Other patents pending

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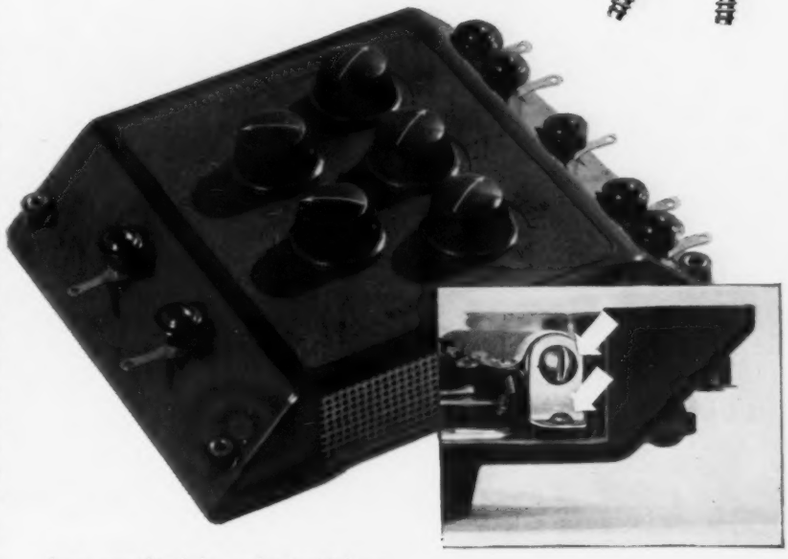
How 8 little Screws reduced costs and improved this Volt Divider electrically

The assembly of the Truvolt Divider involves the fastening of four resistance core brackets to the Bakelite case, and the mounting of composition lava resistance cores onto these brackets. When Electrad, Inc., makers of Truvolt Divider, used machine screws to fasten the brackets to the case it was necessary to mold inserts in the Bakelite — a costly operation. Then, to mount the resistance cores to these brackets, a bolt was run through each core from bracket to bracket — a poor method from an electrical standpoint.



By adopting Parker - Kalon Hardened Self-tapping Sheet Metal Screws for these assemblies, the expensive inserts were eliminated and the device improved electrically. Now, the fastenings are made by simply turning Self-tapping Screws into holes molded in the Bakelite and composition lava.

The simplicity and economy of making fastenings with Self-tapping Sheet Metal Screws has resulted in substantial reductions in assembly costs for such well-known manufacturers of electrical products as: General Electric, Western Electric, Westinghouse, Cutler-Hammer, Foote-Burt, Delta Electric.

Self-tapping screws are so hardened and threaded that they cut their own thread like a tap, as they are turned in. With these Screws secure fastenings—fastenings that stand up under vibration and severe service conditions are made by merely drilling, punching or molding a hole—then turning in the Screws with a screwdriver. When necessary the Screws can be removed and replaced.

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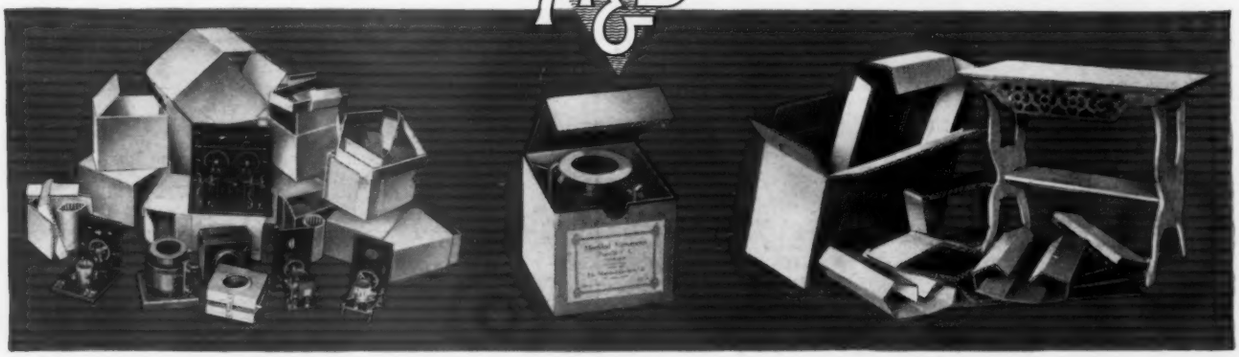

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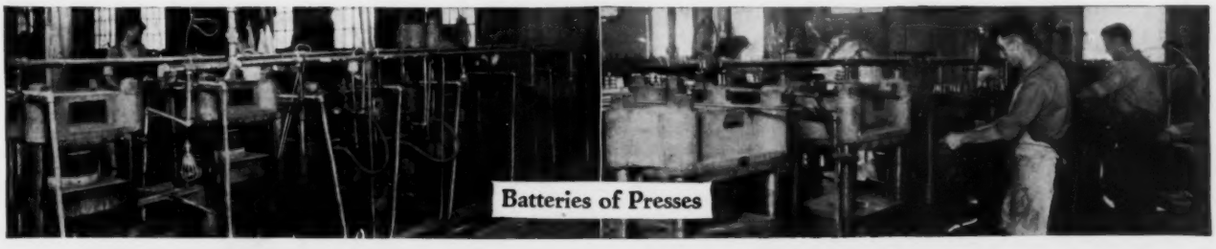

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